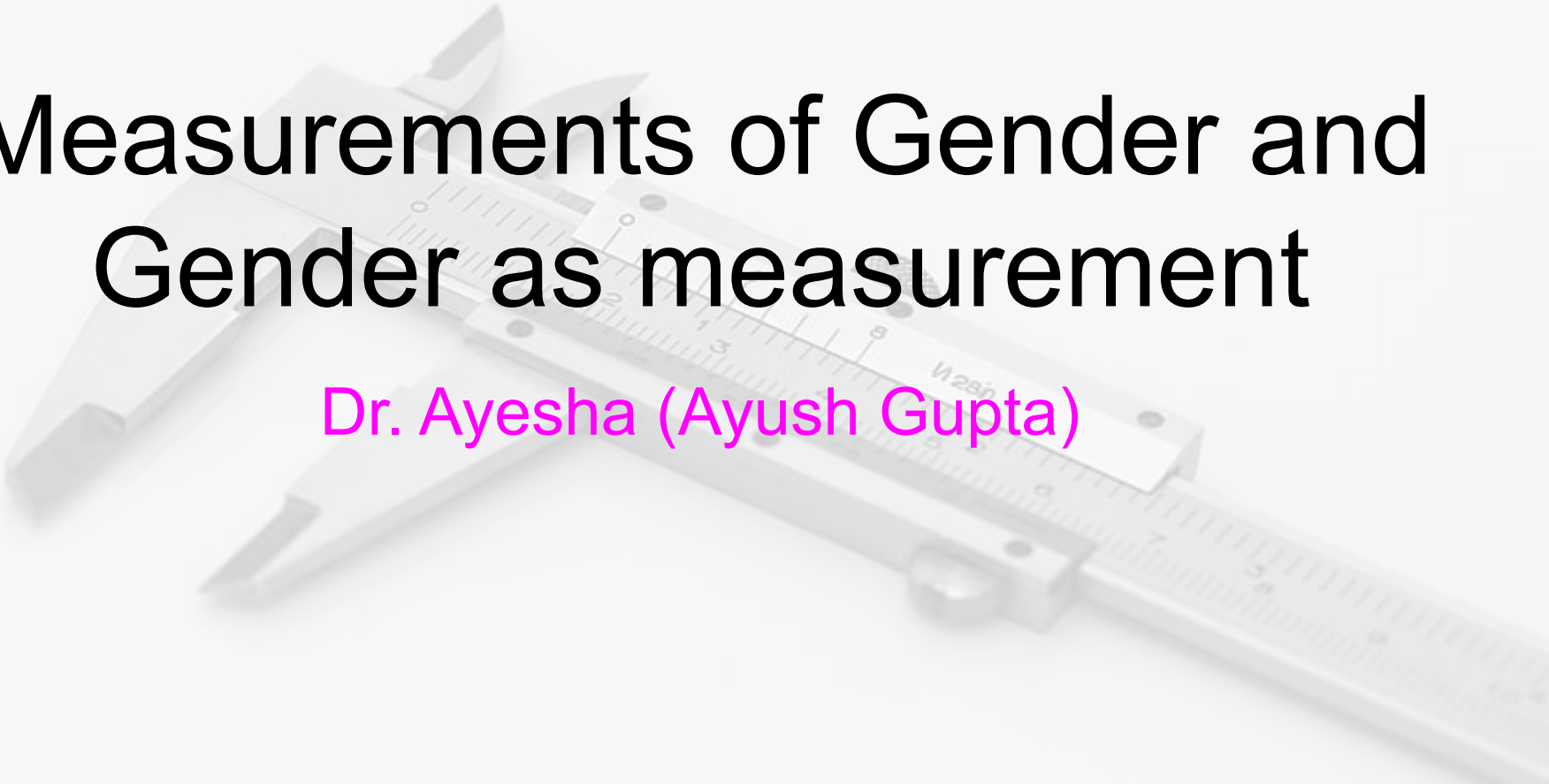


Measurements of Gender and Gender as measurement

A pair of calipers and a ruler are shown in the background, slightly faded. The calipers are open, and the ruler is placed horizontally. The text is overlaid on this background.

Dr. Ayesha (Ayush Gupta)

Measurements - 1

What are we doing today?
Gender as Measurement. Measurement and Power
Gender Measurement as part of science
Where does the binary-sex script come from?
Gender and Sex
Positionality, Movements, History & Measurement of Gender



What is this saying about gender?

- 2 genders
- Segregated washroom space



When we take an image of the world, it is, in some way, a data point on how the world is organised, a *measurement*



How are the cultural scripts (M use M-room...) maintained/implemented and by whom?

- Institutions - formal and informal
 - Schools, public places, hospitals, family
- Punishments
 - kick you out
 - bullied
 - Fines
 - Physical punishment
 - Shaming
 - Self-Censoring
 - Harassment
- Individuals follow and maintain the script
- Peers-teachers
- Society in general



Movements changed discourse (and icons)

- Women's movements; queer/trans movements; queer women's movements
- But bathrooms also place cis-women and trans-women at times, at odds. (

Movements changed discourse (and icons)



How the world is organised matters for who can thrive...who can live.



The transphobic status quo is dynamically maintained

In the USA, in response to visibly-queer people occupying public spaces and using public services, various states and school boards have legislation underway that will force transgender students to use the washroom corresponding to their gender assigned at birth.

There is a certain ridiculousness to the whole situation that we need to recognize:

What a doctor saw in a child's genitals (that is essentially what is meant by gender assigned at birth) will be determining which washroom they use as a young adult/adult, and that regulation would be enforced via institutions of the *democratic* State: school boards, legislation (laws), police, courts, etc.

As the numbers of visibly-queer people in India increase, what will happen here?

The transphobic status quo is dynamically maintained

In the USA, in response to **visibly-queer** people occupying public spaces and using public services, various states and school boards have legislation underway that will force transgender students to use the washroom corresponding to their gender assigned at birth.

To be implemented, the rules require visual measurements of gender to be performed at the first stage. Hence the first test that is required is: whether the person in F-room can be classified unambiguously as F-person and person in M-room unambiguously as M-person. Measurements of gender are being performed in washrooms all the time!

As the numbers of **visibly-queer** people in India increase, what will happen here?

Questions?

I am still thinking of Who really benefits from creating these rules?

no one benefits in long run i think

- Certain people having power in the short term. But society as a whole, long term, the way society is organised, in the long run, society as a whole will not benefit.
- Someway you are going to suppress individuality, and certain folks. Various people not able to contribute to the world
- The chemical castration and ultimately suicide of Alan Turing, Mathematician
- Males have benefited for a long time.
- Oppressor is not emotionally happy

Is this distinction always intended or a lack of awareness?

Why does this matter?

National Education Policy 2020: Section 3.2: “..to provide **effective and sufficient infrastructure so that all students have access to safe and engaging school education at all levels from pre-primary school to Grade 12**. The credibility of Government schools shall be re-established and this will be attained by ... providing safe and practical conveyances and/or hostels, especially for the girl children, so that all children have the opportunity to attend a quality school and learn at the appropriate level.”

Who is included in *all* students?

Why: “especially for the girl children”?

Right to Education 2009

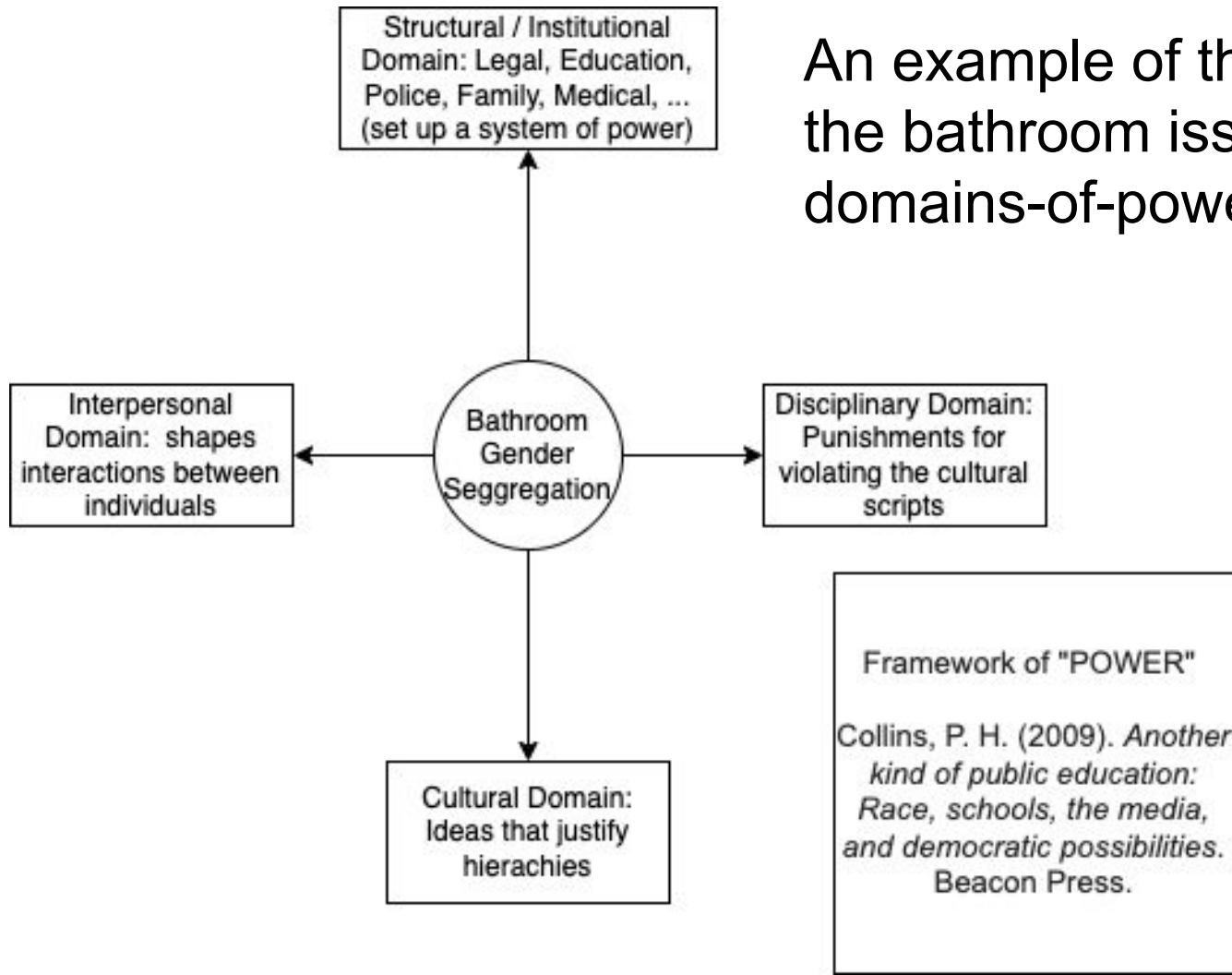
- Chapter 3 provides to **every child of the age of six to fourteen years** the right to **free and compulsory education** in a neighbourhood school till the completion of elementary education.
- Chapter 12 specifies: “separate toilets for boys and girls”

An example of thinking through the bathroom issues under the domains-of-power framework

[Hill Collins, Ch 2](#)

Important Framework

Movements as resistances within these domains
NB: domains are interconnected, not exclusive



Measuring gender by visual cues

Is becoming a high-tech enterprise:

- Facial Recognition Tech
- Gait Recognition

Is including queer people in surveillance mechanisms progress? Progress for whom? How will these tech embed within structural, cultural, and disciplinary domains of power – oppression as well as resistance?

What happens if we look at public washrooms from the eyes of the person who cleans it?

Pls don't answer, just think.

Washroom in India: practices are also shaped by Brahminic ideas of pollution and purity, and the inhuman practice of untouchability, enslaving people in “sanitation work” In India, access to bathroom facilities is also a feminist and a Dalit issue.

Sex Determination of Skeletons: Measurement of Gender in Paleontology

- Both groups reached consensus that the sample can be classified as Female
- BUT differences in Level of Confidence
- Sources of Uncertainty
 - Disagreements on angles and interpretations
 - Weathering and Erosion

Level of Confidence	Numbers
Low	2
Mid	1
High	2

NOTE: The question as asked presumes 2 sex: M/F

What are other ways that you can determine the sex of a person - biologically?

Where does this script that there are two sexes come from?

Like, is the data showing that? What precisely is going on?

Like do the measurements along these various dimensions hold up the idea that there are Men, Women, and a then a small smattering of others?

If we are to do research on gender in STEM, ***and do it scientifically***, then we need to think through measurements of gender, rather than taking cultural scripts for granted. When we take the cultural scripts for granted, we participate in the oppression of marginalised folks. So it is important for us to interrogate ourselves.

Measurement also important for numbers

Are those who do not fit into a gender-binary a minority?

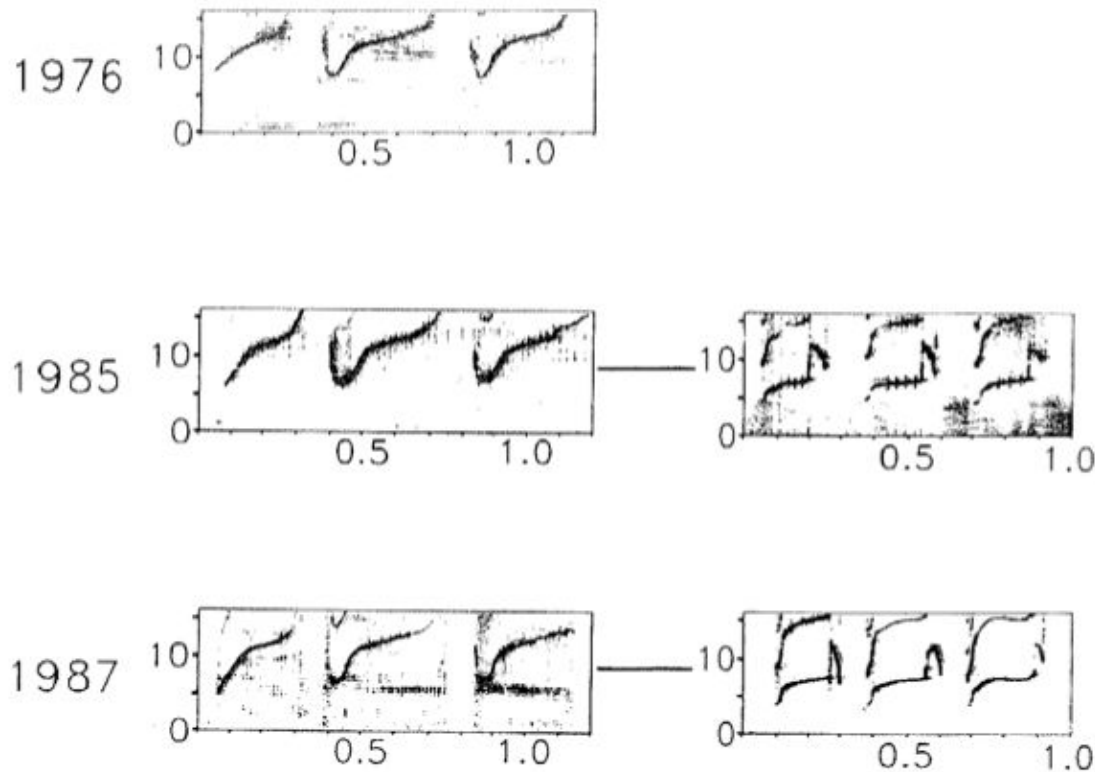
Numbers are used for allocation of public resources. So how we measure matters.

Do Dolphins have gender? If so, what?

Marine biologists have consensus that:

1. Dolphins have signature whistles
2. But interesting variations
 - a. Males progenies have whistles similar to the mother
 - b. Female progenies have whistles less similar from the mother
3. This is explained as:
 - a. Males swim away from the natal family (natal families are held together by adult females, mostly from the same mother). So they need voices to be similar to recognize.
 - b. Females stay with the natal family group. So they need voices to have variations to recognize.

MOTHER NO.16

FEMALE CALF NO.140
BORN 1984

Sayigh, L. S., Tyack, P. L., Wells, R. S., & Scott, M. D. (1990). Signature whistles of free-ranging bottlenose dolphins *Tursiops truncatus*: stability and mother-offspring comparisons. *Behavioral Ecology and Sociobiology*, 26, 247-260.

Fig. 2. Spectrograms of representative favored whistles of mother no. 16 and female calf no. 140. A whistle of the mother recorded without a calf in 1976 is presented to illustrate whistle stability. Lines drawn between spectrograms of whistles of mother and calf in 1985 and 1987 indicate that they were caught together in these years and that the whistles were recorded during whistle exchanges between the pair. Axes are as in Fig. 1

Sayigh, L. S., Tyack, P. L., Wells, R. S., Scott, M. D., & Irvine, A. B. (1995). Sex difference in signature whistle production of free-ranging bottlenose dolphins, *Tursiops truncatus*. *Behavioral Ecology and Sociobiology*, 36, 171-177.

important for males than females as they grow older.

We have suggested in a preliminary study (Sayigh et al. 1990) that bottlenose dolphins, *Tursiops truncatus*, may display another type of sex difference in their whistles. It was proposed that the individually distinctive signature whistles of males resembled those of their mothers, while the whistles of females did not. In that study, eight out of eight females produced signature whistles highly distinct from those of their mothers, whereas four out of four males produced whistles similar to those of their mothers. This sex difference in the tendency to produce a signature whistle similar to or distinct from that

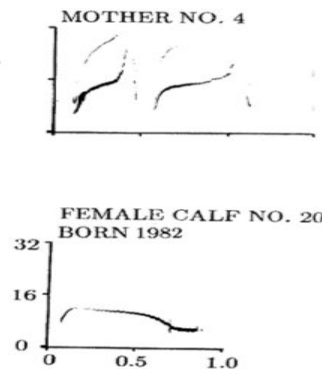


Fig. 2 Spectrograms of whistles of mother no. 4 and her female calf, no. 20. These two whistles received a mean similarity score of 1.0 (least similar) from the judges. Spectrograms were made with a Kay Elemetrics Corporation Model 5500 Digital Signal Processing system, with a sample rate of 81,920 Hz, a 256 point FFT, and a Hamming window. Frequency (kHz) is on the y axis and time (sec) is on the x axis

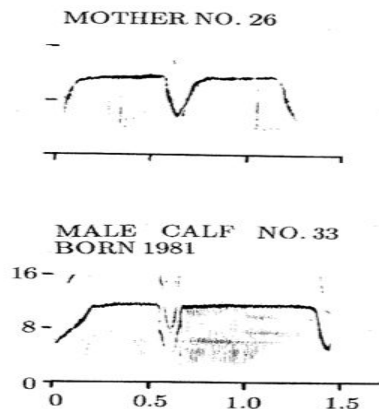


Fig. 3 Spectrograms of whistles of mother no. 26 and her male calf, no. 33. These two whistles received a mean similarity score of 5.0 (most similar) from the judges. Sample rate was 40,960 Hz; all other settings and axes are as in Fig. 2

Table 2 Mean judges' ratings of similarity of whistles of mothers and male calves (in order of descending similarity, on a scale of 1 to 5). Note the clustering of the three male calves of both mother 7 and mother 10 (in **bold face**)

Mothers	Male calves	Mean judges' rating
#50	#160	5.00
#26	#33	5.00
#215	#222	4.85
#126	#129	4.20
#216	#223	4.08
#217	#226	4.08
#7	#142	3.97
#7	#11	3.94
#7	#12	3.77
#1	U	3.39
#35	#30	3.00
#48	#86	2.57
#182	#181	2.47
#42	#67	2.33
#4	#173	1.98
#5	#6	1.67
#16	#177	1.54
#10	#3	1.39
#10	#17	1.31
#10	#166	1.20
#79	#82	1.00

Table 3 Mean judges' ratings of similarity of whistles of mothers and female calves (in order of descending similarity, on a scale of 1 to 5)

Mothers	Female calves	Mean judges' rating
#52	#164	4.20
#16	#140	3.80
#23	#158	3.31
#1	#15	2.92
#2	#18	2.77
#32	#176	2.73
#5	#159	2.31
#68	#147	2.17
#7	#174	1.92
#22	#2	1.72
#9	#187	1.67
#23	#25	1.67
#48	#170	1.67
#22	#148	1.60
#28	#51	1.53
#32	#61	1.39
#8	#13	1.28
#195	#194	1.27
#151	#188	1.20
#10	#144	1.20
#4	#20	1.00

What is this data saying?

Compared to previous study, can't be so sure – for M also, there are 7/21 no similar whistles

Building correlation

Uncertainty: 9/21 male calves having similar whistles to mothers

there is a spread in male data across the similar dissimilar spectrum. female whistles are more often dissimilar. there is no unanimous consensus between the male-similar and female-dissimilar correspondence.

less than half of the male sample have whistles similar to their mother.

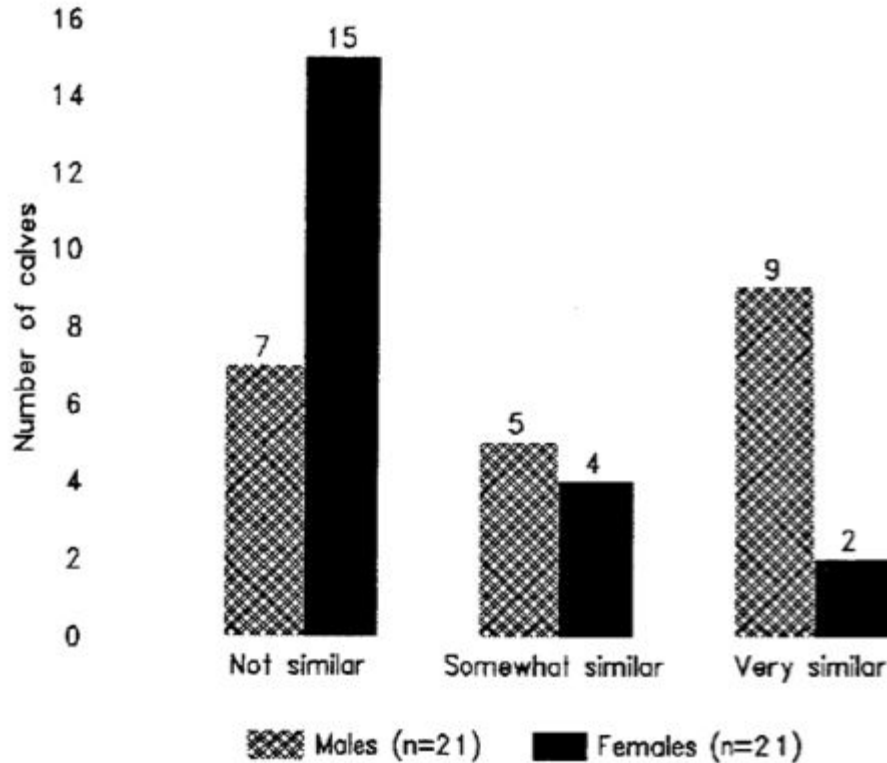


Fig. 1 Mean judges' ratings of whistle similarity between mothers and calves (see text for details on the rating system used)

The discursive production of binary

judges' score = 1.92), than to those of her male calves. The whistle of mother 10 was as dissimilar to that of her female calf, 144 (mean score = 1.20), as to those of her male calves. All of the other mothers were recorded with only one male calf each. Among female calves, no similar clustering was evident, although the greatest number of female calves per mother was only two (see mothers 23, 22, and 32; Table 3).

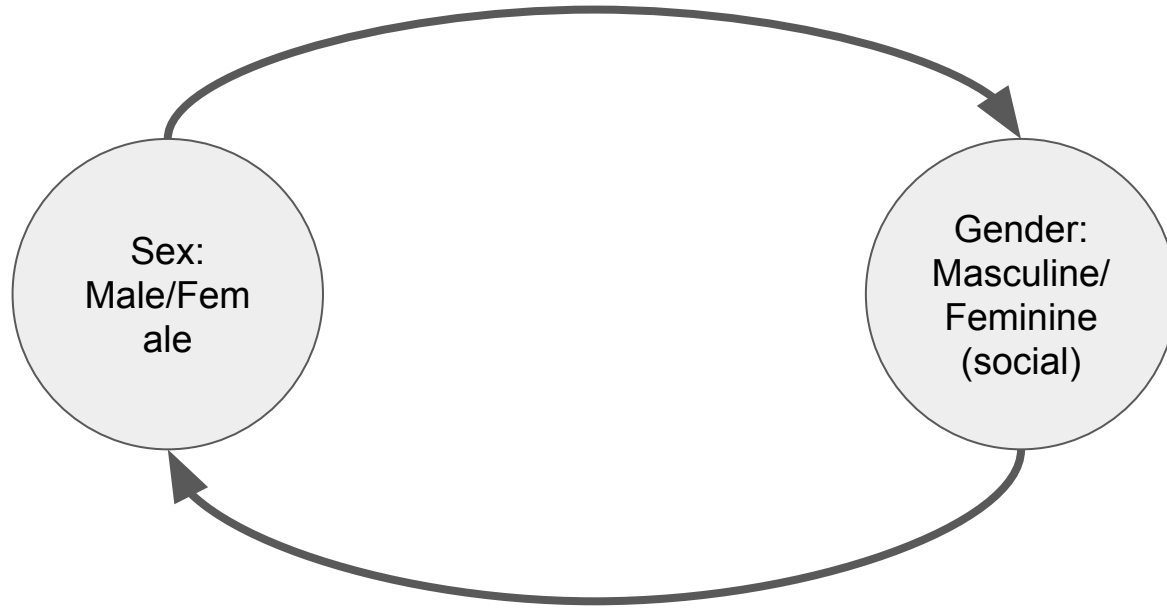
Discussion

This study demonstrates a sex difference in signature whistle production of free-ranging bottlenose dolphins. Male calves are more likely than female calves to produce signature whistles very similar to those of their

mothers, whereas female calves are more likely than males to produce whistles highly distinct from those of their mothers. The question of how this sex difference comes about, i.e., through what combination of genetic and learned components, will be addressed in a later paper (L.S. Sayigh, P.L. Tyack, R.S. Wells, A. Samuels, unpublished work). This discussion focuses on the more speculative question of why such a sex difference might occur.

Sayigh et al. (1990) speculated that sex differences in whistle production may reflect differences in the life histories of male versus female bottlenose dolphins. Because data suggest that adult females in Sarasota frequently associate with matrilineally related females (Wells et al. 1987), it may be important for each female to develop a signature whistle distinctive from other fe-

Sex - Gender



Binary thinking in one constructing the binary thinking in the other.

Some Takeaways

1. Queerness relegated to “noise” through the tools of statistics and hypothesis testing
2. Sex-gender binary are simultaneously re-inforced
3. I could not find any information in the methods on how the scientists are telling the sex of the dolphin: are they doing genital inspection, chromosomes, hormones, ...
 - a. Is the binary sex arrived at via assumption, via rejection of ambiguity in biological characteristics, etc? What is going on here
4. When we see a binary, we should be suspicious not comforted. How are our own realities being constructed: of the mind, but also of the body!!

Who is doing the science, matters!
Methods matter!

So, what about the methods for Shah et al.
How was the knowledge produced?

““As per the judgement of the Hon’ble Supreme Court of India, **Transgender** will be included as a **third gender** under the various scholarships/fellowships schemes of UGC.”

Excerpt From: Shah et. al., “No Outlaws in the Gender Galaxy”. Apple Books.

Implementation requires un-ambiguous determination. (Parallels to caste-based reservations). Potential (guarantee?) for discrimination.

“The constructed "naturalness" of a world made up of two sexes, two genders, and heterosexual desire as the only legitimate desire has been continuously questioned and challenged by those marginalised by these norms. This forces us to ask some important questions: How is gender really understood and constructed in the world that we inhabit? How does it operate through the various socio-political-cultural structures around us? And, most crucially, how is it lived?”

Excerpt From: Shah et. al., “No Outlaws in the Gender Galaxy”. Apple Books.

“This question is necessary but it is not by itself sufficient. The assumption that the gender categories ‘man’ and ‘woman’ are self-evident, and questioning all others who challenge the norms that define these categories, is merely a fallout of the hegemonic understanding of gender itself. At the heart of this issue lies the ‘naturalness’ of the gender binary, the constructed ‘naturalness’ of a world made up of two sexes and two genders, and heterosexual desire as the only legitimate desire. The more crucial questions, then, are: How is gender understood and constructed in the world that we inhabit? How does it operate through the various socio-political-cultural structures around us? What does this mean for people who conform to, or diverge from, its strictly imposed norms?”

Excerpt From: Shah et. al., “No Outlaws in the Gender Galaxy”. Apple Books.

Participation in movements shaped the production of this knowledge in Shah et. al.

- LABIA - Queer Feminist LBT Collective, started as Stree Sangam
 - Who gets to organise together?
 - Questions of access to organising space to question how access to public good is distributed
 - E.g., who gets to sit in the women's compartment of the local train?
- Ultimately, the question becomes, Whose lives are sustained?
- Gender is an economic question
- Gender is a life question, who gets to pursue life and liberty?

Role of Movements

Feminist movements - “the first spaces for political articulations on structures of gender and sexuality.”

“One might say that, though destabilizing, the question ‘What makes me a woman?’ was very much part of this growing change in our collective politics and work. Today, some of us are able to answer this question with, ‘Because that is how I feel.’ But it has taken a long time for this simple thought to sink into our collective consciousness and it is still an ongoing process. At some level, this answer presupposes an innateness of gender identity, something that feminist thought had been deconstructing all along.”

Institutions (Structures) - Movements - Concepts/Scripts

“It was feminism that taught us that we were socialized into becoming women according to what society, family, law, religion and other such structures dictated. It was our experience of being treated like women that made us women. It was not our bodies, but our embodied experiences that made us women. So it was, and for some still is, difficult to wrap our heads and politics around the fact that many of those who are not socialized as women also feel like women. And the next logical step—that their lives and concerns were also as valid a concern of our work and movements as of those who were brought up as women—was even more difficult. Similarly difficult to grasp was the reality of those who may have been socialized as women but felt that they were ‘men’. This took us to torturous debates around the belief that they were saying so to access ‘male power and privilege’.”

The role of language in organising our thinking

“Stree Sangam itself saw a transition, in 2002, from being a ‘lesbian and bisexual women’s group’ to becoming LABIA, a queer and feminist collective of ‘lesbian, transgender and bisexual women’. Our language was still quite uncertain, but in this period many transgender-identified persons joined various LBT organizations and many of us also found the words to voice our concerns in a manner that made more sense. Another important shift that happened in the early years of this century was the increasing use of the word ‘queer’ as both a politics as well as an identity. At one level, there was a realization that the terms lesbian, gay, bisexual and even transgender did not begin to encompass the lived realities and the multitude of identities that people lived with, and at another, a growing maturity of a politics that was invested in contesting the heteronormative constructs of both gender and sexuality.”

“At the same time, those of us, to whom the question was addressed were also in search for a language to express ourselves. The language we have, much like every other thing, is extremely gendered, and again and again, it binds us into categories that we might otherwise be more able to defy. Some people have found the language of ‘trapped in the wrong body’ useful, but for many others it does not work. A few started speaking of their gender being wrong and used the language of gender dysphoria. Yet others kept trying to redefine ‘woman’ because they did not identify with being ‘men’ and did not quite know how to move beyond the binary identities of ‘men’ and ‘women’.”

Takeaways for conducting STEM education/research from feminist lens?

Next

Discussion Section:

- Questions & Takeaways from today's lecture: Pls come having given some thought to this.
- We will work on the framework of power (Analysis of Gender as Power): I will give more instructions on this. Don't worry.

Pre-req: Need to read up on Chapter 2-3 of Shah et al.

Next monday: Getting into demographic data, and what means, etc.

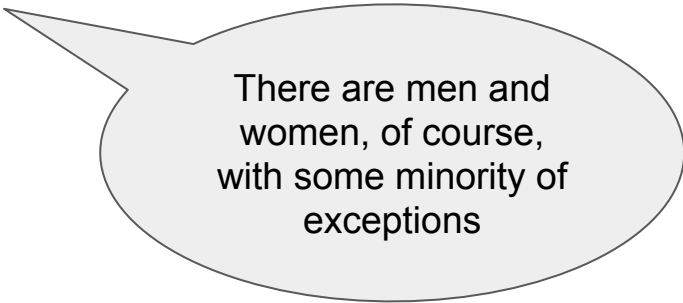
Reading: Fernandez, T., Godwin, A., Doyle, J., Verdin, D., Boone, H., Kirn, A., ... & Potvin, G. (2016). More comprehensive and inclusive approaches to demographic data collection. *Proceedings of the Annual Meeting of the American Society of Engineering Education, 2016.*

Measurements - 2

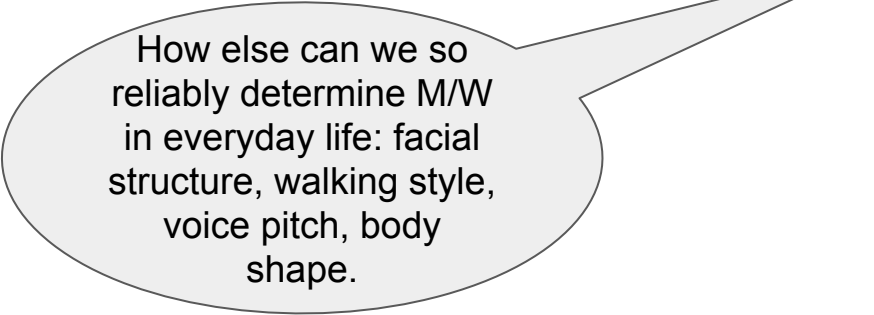
What are we doing today?
Reproduction of the Binary
Challenging the Reproduction of the Binary
GENDER AS Power & Complex Systems tools for Analysis
Interpreting Measurements

Physiological determination of man vs woman: Sources?

- Genitals
- Secondary sexual characters - facial hairs, breast etc, voice pitch
- Men are more muscular than women
- Body shape
- Men have a deep voice than women
-
- Voice
- Hormone profiles

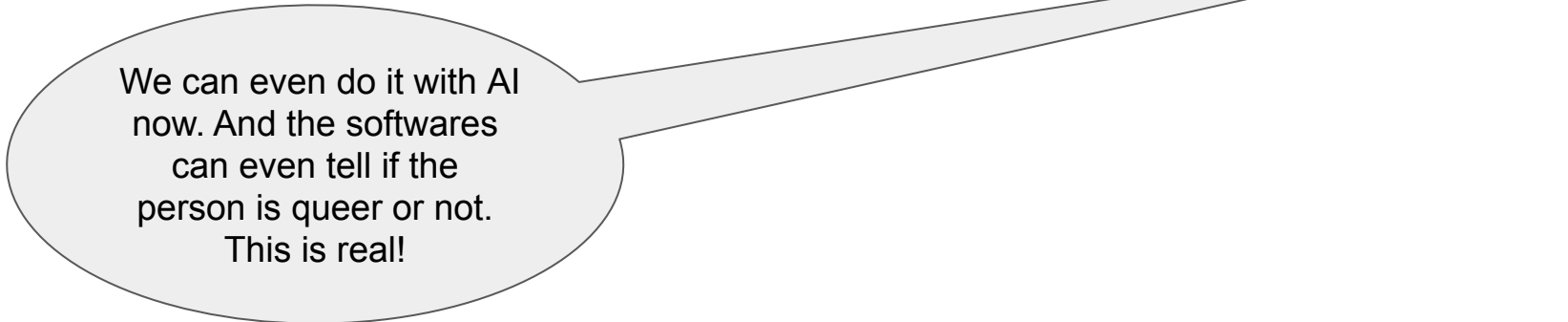


There are men and women, of course, with some minority of exceptions



How else can we so reliably determine M/W in everyday life: facial structure, walking style, voice pitch, body shape.

Sexual dimorphism is a strong intuition for many (reminder: *not all*)



We can even do it with AI now. And the softwares can even tell if the person is queer or not. This is real!

Excerpt: “Gender” by V. Geetha (in Introduction chapter)

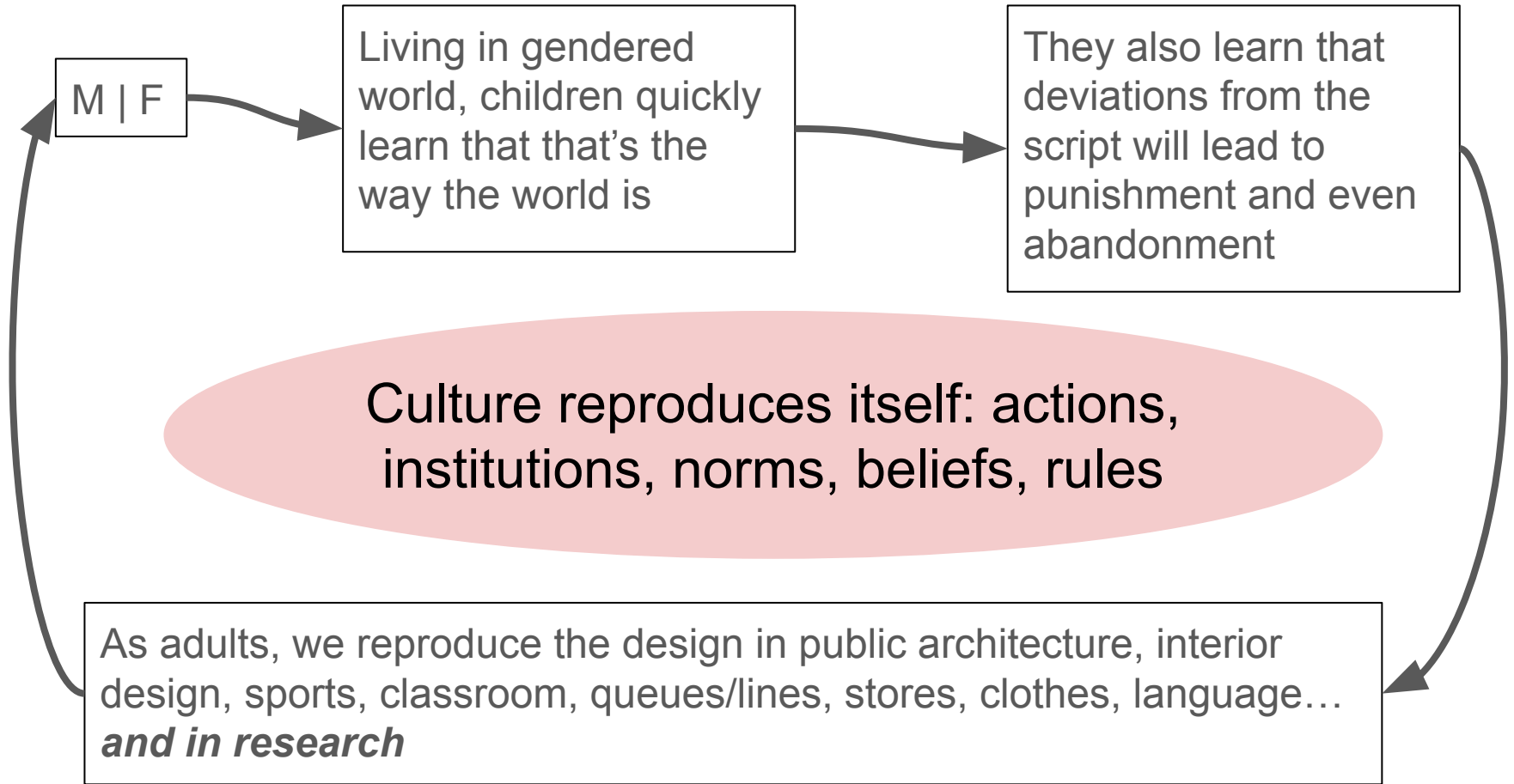
Men and women are so different from each other, how can women do everything that men do? Can they work at difficult and physically strenuous jobs? Nor can men do what women do so well and naturally, such as looking after a baby. Besides, men and women experience life differently: women are gentle, tolerant, whereas men are authoritative, impatient. Given these differences, how can we expect or even ask that men and women be equal? Then, again, do we want to be equal in every respect? Nature has made us different, and we can't really change that, can we?

First let us review how culture plays a role in the reproduction of ideas and then we will get into the biology again

Toilets	Parenting	Classroom seating	Airport security	Various Queues
Reserved Seats in Buses, Trains	Marriage (the girl has to move out of family)	Playground	Jobs	Apartments for singles

What are some of the places/practices where you experience the separation of men and women?

Markets, Advertisements	Religious practices and places	Sports	Textbook illustrations, examples	Fitting Rooms
			Hostels	Clothes sections in shops



The point is that a norm is powerful and influential, not because everyone adheres to it but because it is made to seem universal, though it works well only in certain contexts. In this case, being a good wife and mother, which is a middle class, upper caste ideal, is generalized enough for all women to want to adhere to it. Poor women accept its pertinence, though their lived realities often subvert and contradict the norm. This generalization of a particular ideal happens in extremely interesting ways. It is made to appear a function of one's sex. If you are a woman, you will necessarily want to be a good wife and mother. In other words, a particular historical and sociological identity is displaced onto the female sex as such, and made to appear natural to it.

Such a process of naturalization is even more evident in the case of social expectations. For instance, men are expected to be virile and powerful. But the truth is, in any given situation, at a particular point in time, only some men are powerful and virile. Yet all men expect to feel this way, irrespective of the fact whether they have the means to exhibit their power or display their virility. Consider poor, underprivileged men in rural north India, for example. Often they are employed on big farms run by ruthlessly feudal landlords. They are kept under strict surveillance and control. Their wives and daughters are even more vulnerable than they are: at any time they can be sexually assaulted or raped by the landlord or his cohorts. In this situation of total powerlessness, how can a man expect to feel either power or virility? But men feel the need to prove their manliness, so to speak, and when they do, it is pitiful and tragic, and exercised at the expense of their wives and children. And even when it is

Articulate and interrogate your own assumptions.

All of us are reproducing *and resisting* cultural reproduction in different ways and to different extents

Unless you are allowing your epistemology and actions to be transformed, that is not feminist research!

Assumptions

Initially sex and gender were not supposed to be separate.
Female as flawed/lesser male

But then things shifted, and doctors and biologists found gender differences in many parts of the body.

Feminists argued to separate sex and gender. Sex - biological and in the realm of science/nature. Gender - in the social realm, nurture.

Two arguments emerge from separation of sex and gender:

1. How much of the difference that is being observed is biological and how much is an effect of social organisation?
2. We can still have social equality, even with bio-differences

This has had limited success. Differences everywhere
Separate but equal has not worked!

CHALLENGING THE BIASES OF SCIENCE

I argued earlier that the language of science was not particularly critical or objective when it came to the question of sexual difference. As a result, we have scientific notions of male and female beings which more or less reproduce arguments that assert that women are unequal to men. This has lead to the sciences remaining essentially male domains, and scientific thought refuses to concede that its own conclusions often rely on unexamined notions of masculinity and femininity. Even those women who pursue science seriously have to work within a system that refuses to acknowledge both the

facts of sexual difference, as well the meanings that we have attached to them. Science establishments demand a degree of concentration and absorption which women cannot bring to their vocation, should they be pregnant or lactating mothers. While maternity leave is granted to women, many demur from accepting long maternity leave and some are known to fill in these hours of rest, writing and researching papers! Women scientists find they have to function in a context where unless they work twice as hard as men, and prove themselves three times as good as them, they are likely to be discouraged.

Until recently science has played a role in perpetrating theories of racial superiority and inferiority. For several decades, scientists lent their names and credence to theories which maintained that non-white races are innately irrational and cannot be taught the ways of modern science. Though most of these theories stand discredited today, they exist at the level of commonsense, and are invoked from time to time in the service of things such as intelligence quotient tests or in genetic research. It is surely not accidental that science has remained not only a male domain, but also one dominated by white men.

None of these disadvantages have prevented non-white races and women from engaging in scientific research or theory-making. While the scientific establishment remains a white male preserve for the most part, women—and non-white men—have challenged the theoretical assumptions of science in different ways: historians and philosophers of science from non-white contexts have argued that science is as much a product of culture as anything else and that Western science reflects the biases of Western culture. They have pleaded for a more inclusive and catholic view of science, and one that accommodates different notions of truth, objectivity and verifiability than those specified in science as most of us know it.

Questioning the binary

1. Historical – understanding how the ideas about men and women came to be historically –
 - a. within complex systems of society (Geetha, [Gender](#))
 - b. within complex systems of science (Oudshoorn, [Beyond the Natural Body](#))
2. Critically re-analyzing the data
 - a. Dolphins example
 - b. Skeleton
3. Queer approaches into science

Role of hormones in production of male/female

Hormones have come to occupy a special place in our imagination as mechanisms for production of sex differences

But feminist biologists are starting to question this

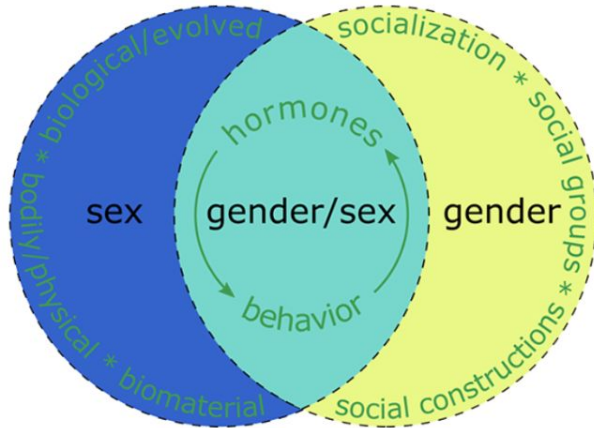
Sari van Anders:

<https://www.queensu.ca/psychology/van-anders-lab/index.html>

“Our lab focuses on gender/sex and sexual diversity, sex research, social neuroendocrinology, and feminist and queer science. To do this work, we develop unique tools and innovative paradigms, models, measures, and theories. We use diverse interdisciplinarily methods that include quantitative and qualitative work, visual analyses, knowledge mobilization, and more. We have won over 90 awards for our science, scholarship, leadership, and academic work.”

Science is starting to integrate sex and gender

Gender/Sex



We use the concept of "gender/sex" (van Anders & Dunn, 2009; van Anders, 2015; van Anders, in press) to refer to phenomena, features, and whole people where gender and sex intertwine, could both be relevant, and/or the two cannot be disentangled easily or at all. Typically, human biology focuses on sex (femaleness, maleness, maybe sex-diversity) while sociocultural research focuses on gender (femininity, masculinity, maybe gender-diversity). Gender/sex expresses a more empirically accurate entanglement in queer and scientific terms. We ground our work in the gender/sex of "Sexual Configurations Theory", which we developed to help conceptualize this and other phenomena, and provide innovative, inclusive, feminist, queer, and scientifically meaningful ways of measuring and addressing gender/sex.

Also look up Anne Fausto Sterling on [SexGender: Biology in Social World](#) ...

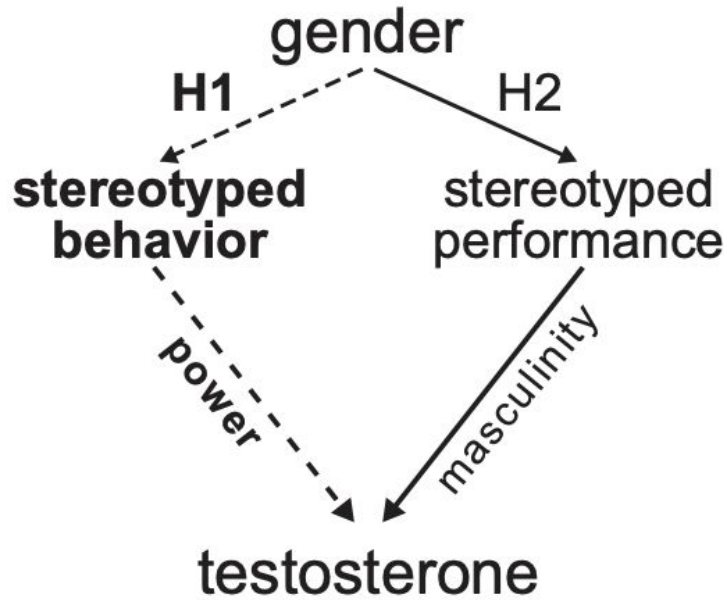
Van Anders, Abstract excerpt

Van Anders, S. M., Steiger, J., & Goldey, K. L. (2015). [Effects of gendered behavior on testosterone in women and men](#). Proceedings of the National Academy of Sciences, 112(45), 13805-13810.

“Testosterone is typically understood to contribute to maleness and masculinity, although it also responds to behaviors such as competition. Competition is crucial to evolution and may increase testosterone but also is selectively discouraged for women and encouraged for men via gender norms. We conducted an experiment to test how gender norms might modulate testosterone as mediated by two possible gender→testosterone pathways. “ (from Abstract)

From van Enders et. al., 2015

“Human biology is typically studied within the framework of sex (evolved, innate factors) rather than gender (sociocultural factors), despite some attention to nature/nurture interactions. Testosterone is an exemplar of biology studied as natural difference: men’s higher testosterone is typically seen as an innate “sex” difference. However, our experiment demonstrates that gender-related social factors also matter, even for biological measures. Gender socialization may affect testosterone by encouraging men but not women toward behaviors that increase testosterone. This shows that research on human sex biology needs to account for gender socialization and that nurture, as well as nature, is salient to hormone physiology. Our paper provides a demonstration of a novel gender→testosterone pathway, opening up new avenues for studying gender biology.”



“we designed our experiment to disentangle power from masculinity where the two are typically conflated, so that we could assess two competing mediating pathways from gender to testosterone.”

Van Anders, et al., 2015

Fig. 1. Two hypothesized gender → testosterone pathways (our results supported the bolded pathway). In H1, the stereotyped behavior pathway, what behaviors women and men do influence testosterone: Wielding power, which social norms encourage for men but not women, increases testosterone. In H2, the stereotyped performance pathway, how men and women perform the same behaviors influence testosterone: Behavioral overlaps with masculine, but not feminine, gender stereotypes increase testosterone.

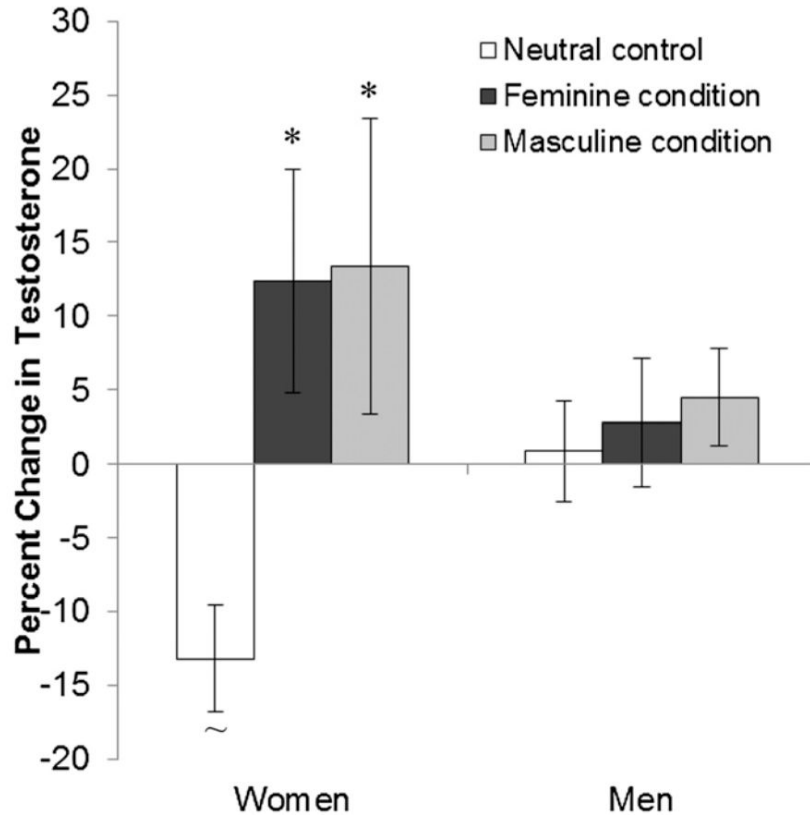


Fig. 3. Mean percent change in testosterone in women ($n = 15$) and men ($n = 26$) by condition, accounting for relationship status, with SE bars. Asterisk indicates a significant difference from "~" at $P < 0.05$.

Wielding power increased testosterone in women regardless of the gender stereotyped way it was performed, supporting H1 (stereotyped behavior) over H2 (stereotyped performance).

Van Anders, et. al., 2015

“Our findings add to growing evidence for the reverse relationship and extend it to gender: that gendered behavior modulates testosterone. Our results would support a pathway from gender to testosterone that is mediated by men engaging more frequently than women in behaviors such as wielding power that increase testosterone. This suggests that, when gender norms constrain behaviors that affect testosterone, gender norms can mediate effects of gender on testosterone, for example by encouraging wielding power for men and discouraging it for women (24).”

Van Anders, et. al., 2015

“Why do men have higher testosterone than women? Clearly, heritability—nature—plays a large role in this difference (34, 35). Our research points to an additional reason for differences in testosterone: the understudied role of nurture—social context. Social context akin to gender norms may have biological consequences when gender norms overlap with evolutionarily salient phenomena such as wielding power. Because wielding power is subject to gender-specific socialization, gender socialization can constrain how frequently women and men engage in behaviors that affect testosterone. Testosterone thus reflects some combination of both heritable and social influences.”

Van Anders, et. al., 2015

“A major implication of our experiment is that gender socialization can contribute to variation in human testosterone levels. Our findings show that discrete events of gender-related socialization may account for some portion of the observed “sex” difference in adult testosterone levels. This adds to growing evidence that gender and sex are more permeable categories than is typically accounted for in bioscientific research (38) and opens up new questions about physiological pathways that link gender socialization to human biology.”

Van Anders, et. al., 2015

Questions

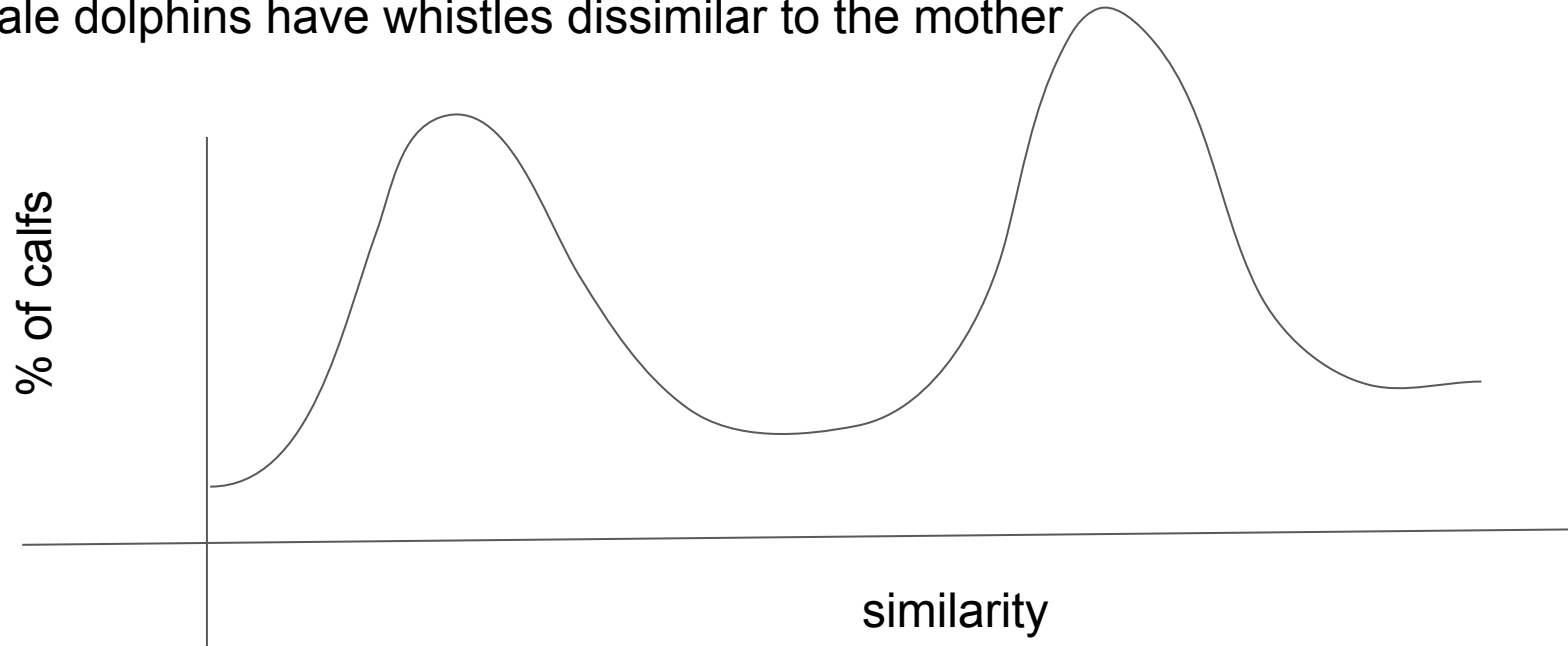
1. These ideas are used across humans and non-humans. Non-human phenomena are used to justify tradition as “natural”

Quick experiments with the dolphins data

What should we expect?

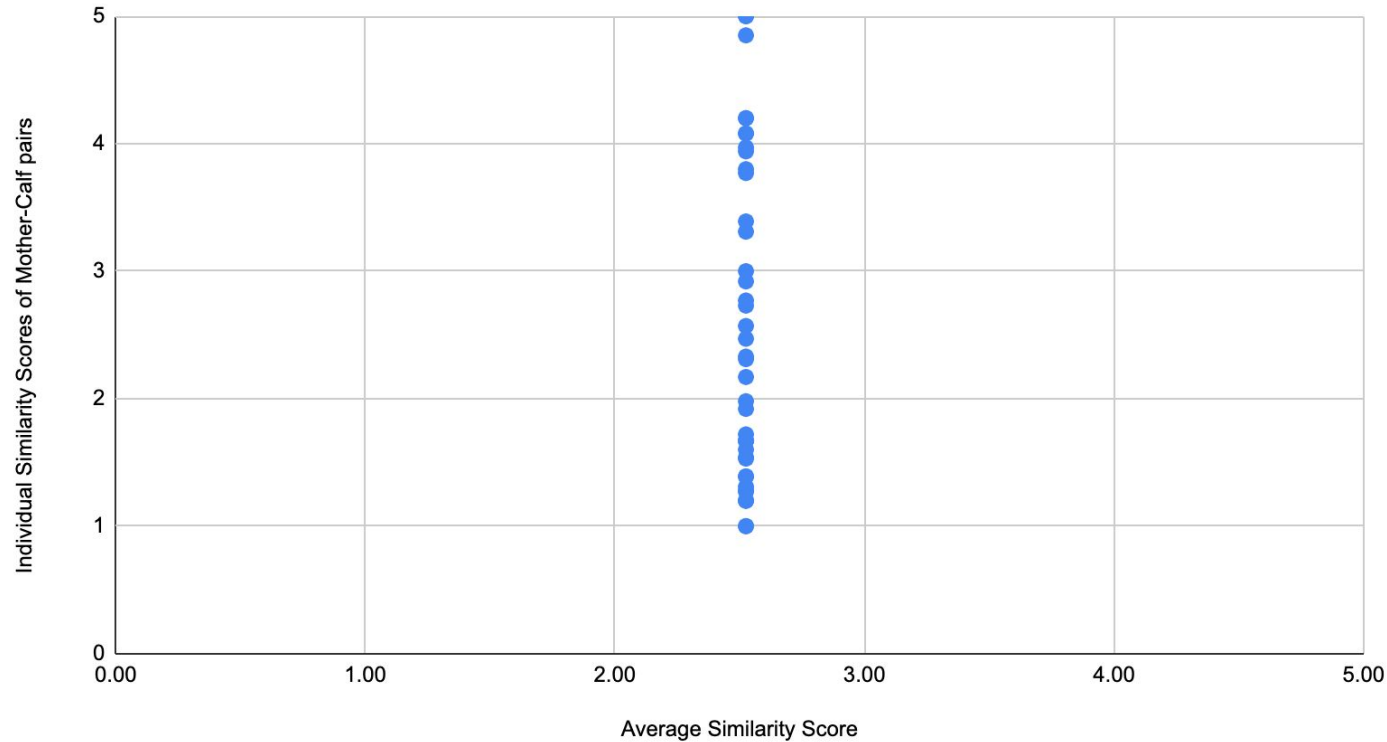
Male dolphins have whistles similar to the mother

Female dolphins have whistles dissimilar to the mother



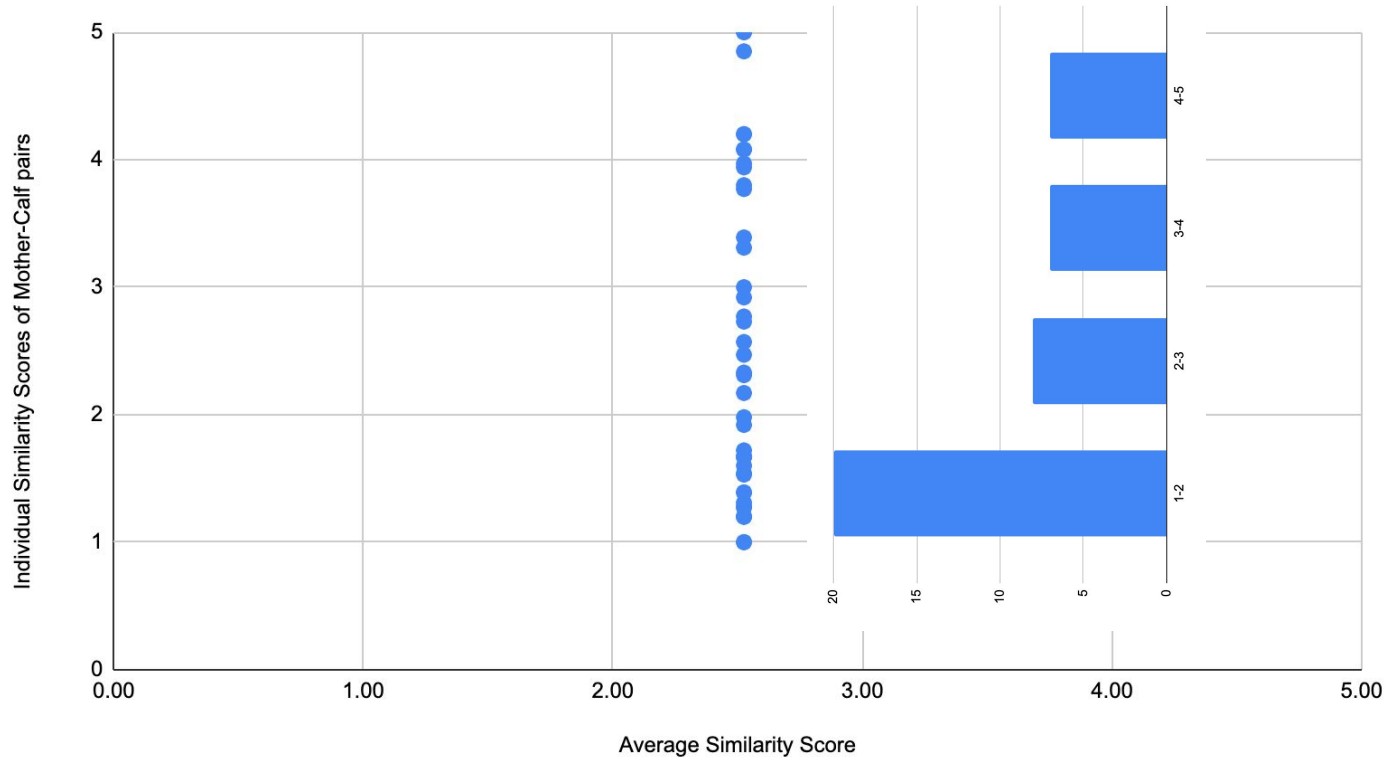
Patterns?

What if we did not differentiate M/F

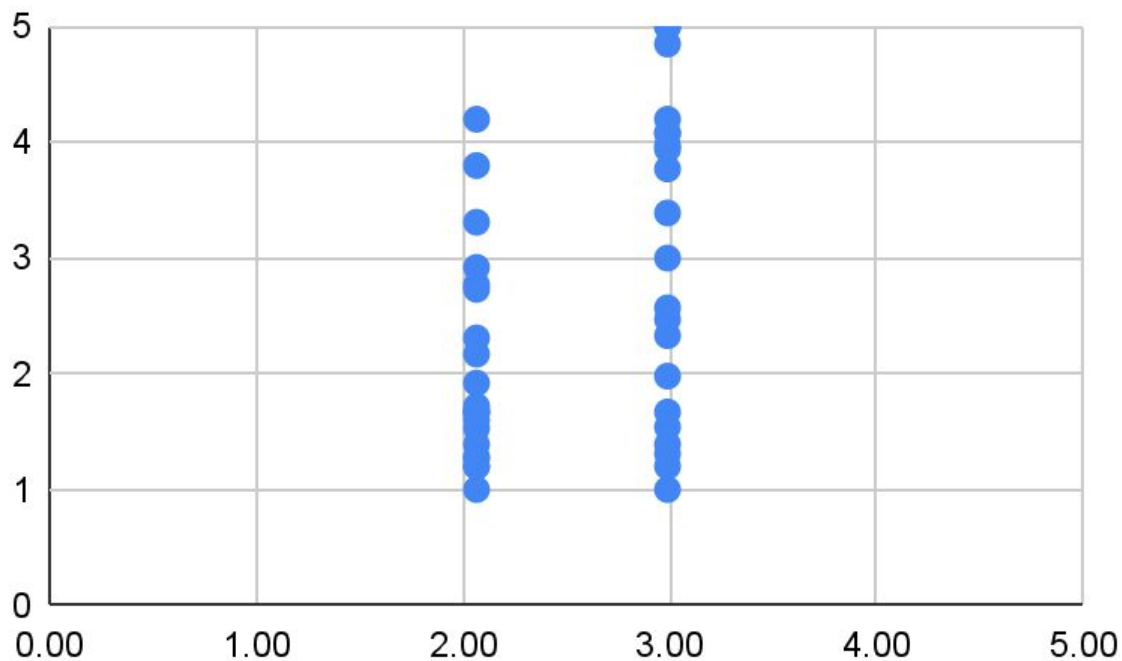


Patterns?

What if we did not differentiate M/F

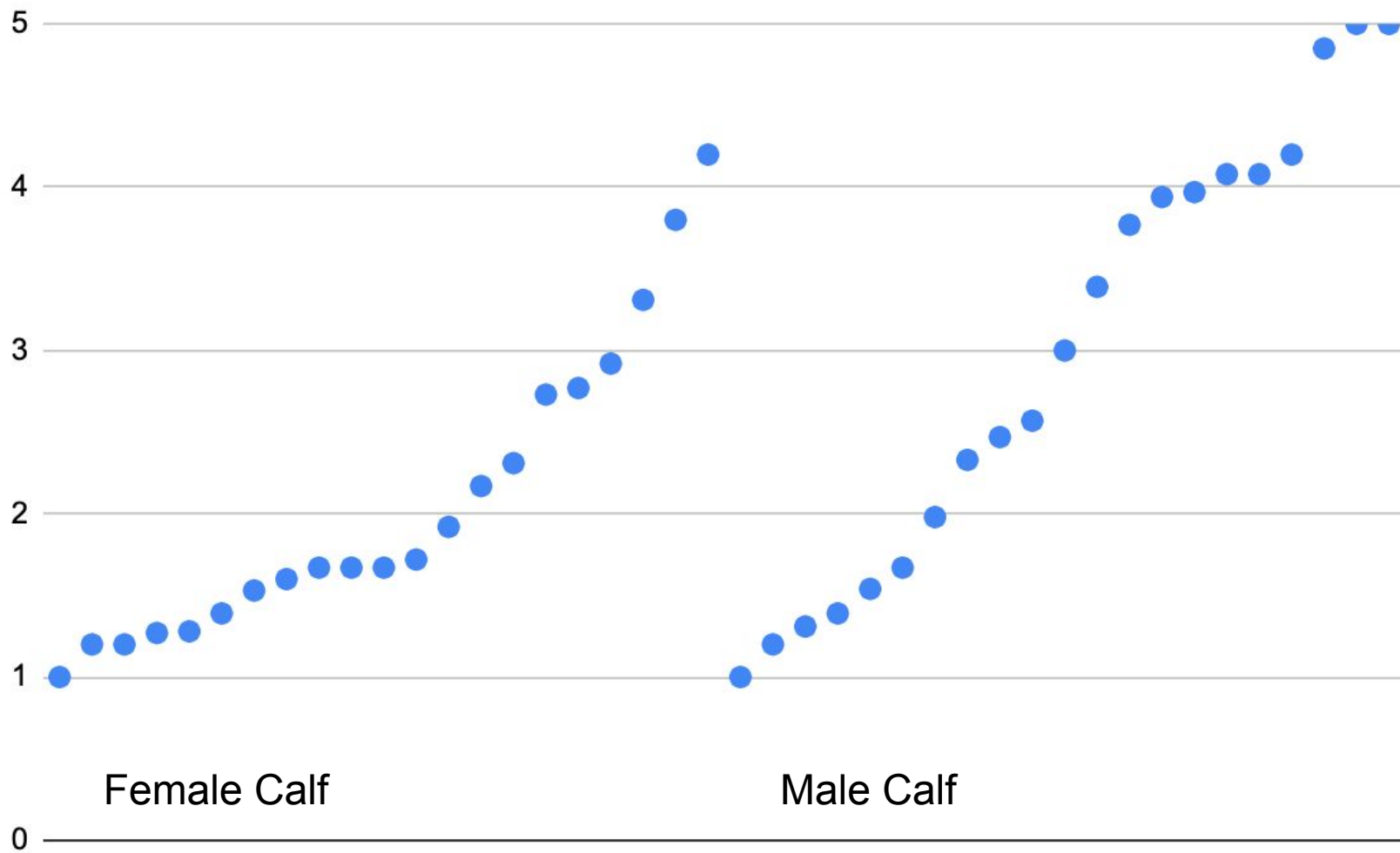


Most offsprings have a dissimilar whistle

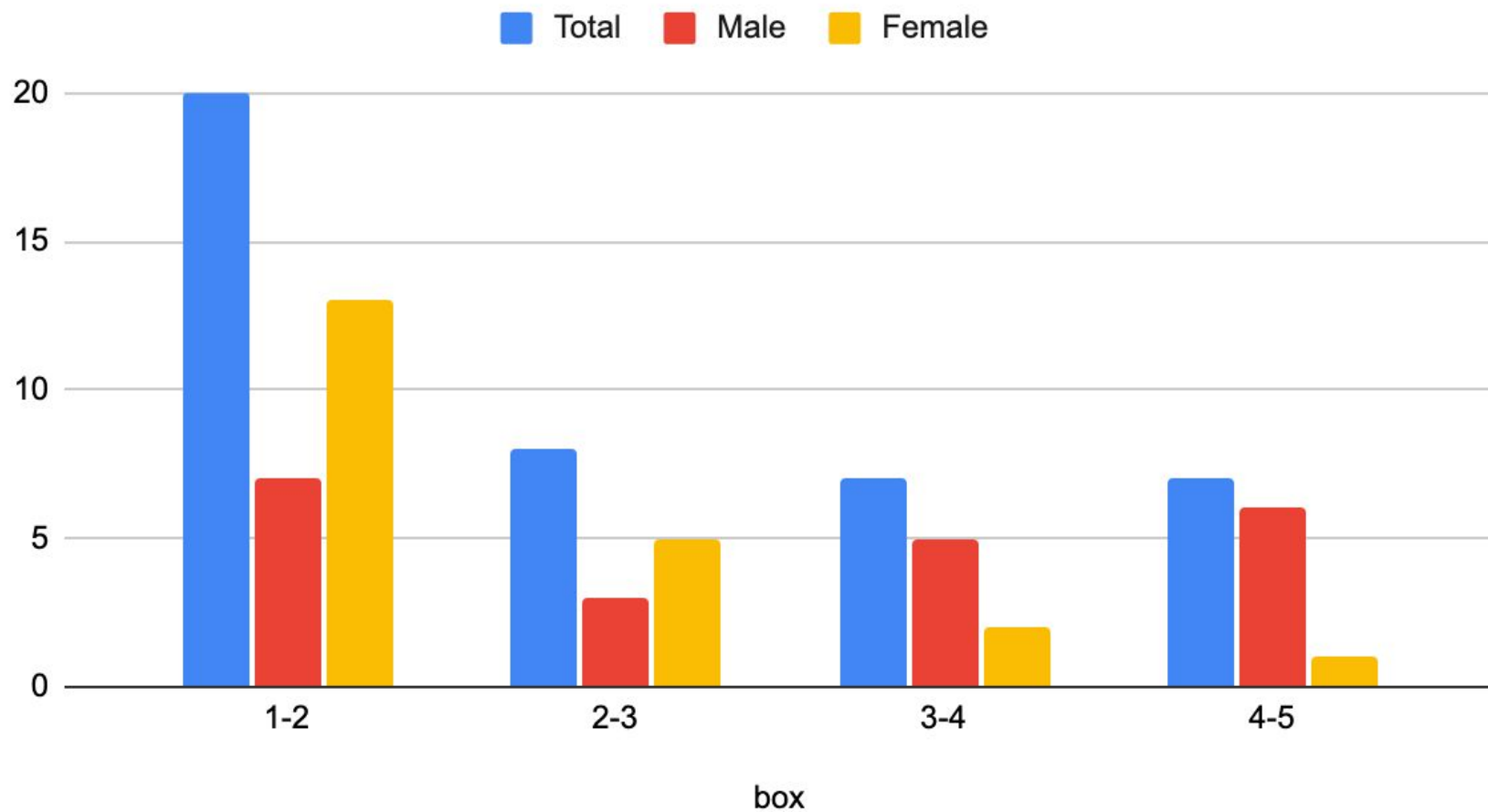


Female
Calf: Avg:
2.06

Male Calf:
Avg 2.99



Total, Male and Female



New Questions

Does the in-group vs out-group pattern hold for similarities/dissimilarities?

Maybe we look at the in-group/out-group in a network architecture, and look for whistle patterns within-group and out-group without first looking at the sex of the dolphin

What is going on with males and females who go out of the natal group? Stay inside? (There is some evidence that “males leave the mother” and “females stay with mother” are also not quite as categorical as the claims make them to be.)

What kinds of power dynamics might be at play in determining who leaves?

Questions?

The point is science is as susceptible to the influence of ideas of masculinity and femininity as any other system of knowledge, though it constantly attempts to distinguish itself from all other knowledges, on the basis of its logic and objectivity. In this sense scientific language too is marked by history—of what people have thought and said over centuries. As long as the language in which we speak, communicate and think has these built-in, historical assumptions regarding male-female differences, the metaphors and similes we employ to explain the world around us are bound to reproduce these differences—even if we are doing science.

We need new languages that are anti-patriarchal

Understanding power becomes central - now
also from the lens of biology

Hence, Collins' domains of power framework
is so important!

Gender Sex Sexuality

“For yet others like Nidhi, hir partner’s perception informs hir notion of hir gender—ze said, ‘My girlfriend thinks me male in terms of gender, I consider myself lesbian in terms of sexuality.’ ”

Excerpt From: Chayanika Shah. “No Outlaws in the Gender Galaxy”. Apple Books.

When we are measuring demographic characteristics, the typical assumption is that these are somehow mutually exclusive.

Instead we need to think of whether and how the categories might be linked.

(Fernandez, Godwin, et al. 2016 also warn against this)

Interpreting Measurements: Gender differences in Science (Geetha)

39 Let us look a little closely at the 'girls-like humanities' and boys are good at science' argument. Throughout recorded history, girls were denied access to scientific learning. Science academies and societies in Europe explicitly forbade female membership. Besides, male scientists were asked to keep away from the distracting influence of women so that they could devote their minds to the pursuit of scientific truth. Not only were women thought of as having lesser minds, but they were also considered potentially disruptive of scientific enquiry. Girls could study science at home if they wished to, and some did,

with the encouragement of kind fathers or brothers, but they were invariably exceptions. Besides, as the historian Gerda Lerner points out, to do science, one must possess the time, leisure and an enabling, unfettered space to indulge in abstract thought. For women this has been difficult, since the conditions of their lives do not allow them to get away from the distractions of the everyday: from cooking, feeding, cleaning, caring. Caught and enmeshed as they are in detail, how can they think in general and in abstract terms?

Given this history, it is not surprising that girls did not seek out the rarefied domains of scientific knowledge. Studying languages or history at home, learning music or writing verse of fiction did not demand an intensive engagement with institutions and academies of learning, nor did they require long hours of absorbed concentration. The study of the 'humanities' could be pursued in those delicious interstices of time which women found between chores. However, this does not mean that the scientific vocation did not attract women. There were women who tried to teach themselves and actually succeeded in working on their own. But many of them had to endure an enormous amount of emotional privation, loneliness and frustration that it seemed to them that they were perhaps unfit for the job!

Principles

Think in terms of complex systems

- *Many interacting heterogeneous entities*: Institutions, norms, rules and laws (punishments), and everyday interactions all entangle to produce lived realities
- *Self-organising*: how certain properties can reproduce themselves by the actions of actors (human and non-human) within the system
- *Feedback loops* - think in terms of feedback loops.
- *Complex systems have histories*: important understanding how things came to be this way
- *Systems of oppression intersect*
- *Concepts - measurement interactions: measurements can produce concepts.*
Gender and racial differences were used to justify that these are real categories and to justify ranking and oppression.

Interpreting Measurements:
[APS LGBT Climate Report](#)

Slides 9-10

% of queer physicists in American Physical
Society

Questions?

Interpreting Measurements: No Outlaws in the Gender Galaxy

1. Gender measurements - categories
2. Gender-Sex-Sexuality
3. Intersectionality & experience
4. Demographic data

Table 3.1: Respondents' Articulations of Their Current Gender Identities

<i>Man (10)</i>	<i>Woman (22)</i>	<i>Others (18)</i>
Man	Woman	Confused
Boy	Bisexual woman	Shifting from female to male
Male	Girl	Confused and variable
Male (but use FTM for others to understand)	Female	Gender queer
	Androgynous female	FTM
	Woman with a difference	Other
		Androgynous
		Fluid woman
		Do not articulate
		Society made me feel a woman but I have denied and challenged it
		Between transgender and lesbian
		50 per cent male and 50 per cent female
		Man but have come to terms with socially being seen as a woman
		Transgender
		Think as woman but am not sure
		Woman from outside but not fully a woman

- Institutional
- Countable
- Supports Hierarchy
- Purpose: Management
- Divisions between groups
- Power

- Psychological
- Counting does not make sense
- Resists Hierarchy
- Potential for Solidarity across groups
- Freedom



Categories (in the world) Support Hierarchy

Intersectionality in the data

1. Experience is shaped by multiple systems of oppression
 - a. In the narratives in Shah et. al., we see how participants poverty, caste status, sexuality and gender all were simultaneously impacting the participants.
2. The role of institutions such as family, school, police, Govt ministries (passport ref.), job market, are all entangled with the reproduction of gender and how that is stifling for queer people (*but now with some deeper meaning to queer*)

V. Geetha, in Gender reminds us that the multiple systems of oppression are not simply linked in experience but the logic of these systems itself is interlinked.

In a Youtube talk, Geetha notes: we cannot annihilate caste without thinking about patriarchy. Ambedkar and Periyar in their analysis of caste link the logics of caste to the logics of domination of women, in particular of women's sexuality. Without the control of women's sexuality, caste system would not function.

See how caste, sex, and sexuality are interlinked? (And without even invoking "queer" people and their wily agendas!)

What's next?

1. Discussion Sessions

- a. Fernandez, T., & Godwin, A., & Doyle, J., & Verdin, D., & Boone, H., & Kirn, A., & Benson, L., & Potvin, G. (2016, June), [More Comprehensive and Inclusive Approaches to Demographic Data Collection](#) Paper presented at 2016 ASEE Annual Conference & Exposition, New Orleans, Louisiana. 10.18260/p.25751 (Please read)
- b. Designing demographic data collection

2. Readings for Next Week

- a. Beddoes, K., & Borrego, M. (2011). [Feminist theory in three engineering education journals: 1995–2008](#). Journal of Engineering Education, 100(2), 281-303.
- b. Brotman, J. S., & Moore, F. M. (2008). Girls and science: [A review of four themes in the science education literature](#). Journal of Research in Science Teaching, 45(9), 971-1002.

Measurements - 3

What are we doing today?	
	The problem of narrow seeing
Understanding Scripts	The problem of interpretation
The logic of caste	Curious issues with collecting data
Demographic questions in the indian context	Stereotype Effect
How do we understand selection choices	Van Anders → implications for science education and gender

Topics for today

1. Understanding Scripts
 - a. Citation and liberation (Kumashiro)
2. The logic of caste
3. Demographic questions in the indian context
 - a. Decolonizing transgender
4. How do we understand selection choices
 - a. Selection of topic, research question, research purpose, site of work, research instruments, participants ...
 - b. Seeing caste and gender in these selections
5. The problem of narrow seeing
 - a. Cid and Kanim
 - b. The race in math demography paper
6. The problem of interpretation
 - a. Back to Shah et al
7. Curious issues with collecting data
 - a. Andrea Haverkamp
8. Van Anders → implications for science education and gender
9. Stereotype Effect

themancompany  Sponsored

India's No. 1
Choice For
Light Lips

Lightening Lip Balm

Lightening Lip Scrub

FREE

Shop Now

345 likes

themancompany You visited the site and now start shopping.  ... more

View 1 comment

What are the cultural scripts here?

- Light lips are desirable
 - Anti-blackness: fair == better
- Our bodies need extra support; need protective layer (on lips)
- “ManCompany”
- Men have darker lips
- Skincare is feminine → subverting that script
- The man in the image also has beard, thus stereotyping how a man should look like

Even when we challenge scripts, we could be reinforcing scripts

Kumashiro, K. K. (2000). [Toward a theory of anti-oppressive education.](#)
[Review of Educational research](#), 70(1), 25-53.

For example, while adding a category for people who do not want to identify as Male or Female on a form - while creating space, still upholds the idea of queer/trans/non-binary people as deviant (as “other”, “prefer not to say” etc might imply). The term, “Third gender” reinforces the script that men are the first gender.

Visiting Open Questions

Has the access to public space for women resulted in an improved access to non binary people as well?

Visiting Open Questions

How the access to public space for women resulted in an improved access to non binary people as well?

- Access to public space has been a central struggle for women and queer people alike.
- The example from bicycle history – blurring boundaries of woman and gender
- Pharr, S. (2000). [Homophobia: A weapon of sexism](#). Making sense of women's lives: An introduction to women's studies, 424-438.

Q: Why is access to public spaces for femme (or feminine presenting people including women and queer folks) an issue for STEM Education Research?

- Limited access to roles (even if access to space is there)
- Access ensures STEM education practices reflect the needs of all people including women and queer folks- so lack of access becomes an issue. – You need to access public spaces to reach an educational institution
- Note that NEP2020 and RTE-2009 also recognize that learners need to feel safe not just inside the classroom but also where they live and in public spaces, in order to be able to learn well.
 - Operationalising these thoughts into policy might be another matter ... (and can be quite challenging too)

Logic of caste & patriarchy

- Rules of boundary setting for jati
- Rules of interaction across boundaries
- Graded Hierarchical system
- Regulation of who can marry who was one of the most important rules
- Deeply oppressive & dehumanising system

Rules around marriage help us see how the underlying logics of caste and patriarchy are linked.

- Rules around relationalities within families, esp governing and regulating hierarchies between men and women but also graded hierarchies within men and within women
- Big point: control of women's sexuality/reproduction

Castes In India (Dr. Ambedkar)

Questions?

An important piece to read! (not for the sake of a course, but ...)

- Created by the Brahmins, then gradually adopted/adapted/forced onto others
- Marriage rules bound up in endogamy and exogamy (you cannot marry within particular similar-status-communities; but you also cannot marry above/below your status group communities)
- In this paper, Ambedkar works out how to maintain such a system, it would automatically produce social practices such as child marriage, abuse of widows, and sati.
- In linking how the rules of marriage are deeply linked with the control of women's sexuality & reproductive ability, we can see how caste and patriarchy are really joined at the hip in the Indian context!

(as a science education researcher) Why should we want to know the demographic information of participants?

- Social locations are strongly tied to accesses and privileges when trying explain phenomenon such learning
- I think it is important to know which group is being discriminated against?
- We don't have data for accurate representation – we need data for policy
- If we want to know about the learning process it needs to be understood from the lens of where they come from. Specially in India where every state has a different system within their families, societies, etc. without understanding that we will not really unfold the learning process of the learner.
-
- To study intersectionality.
- To reflect upon the inclusion of various groups- their needs, voices.
- Being careful while making big claims.

These are all great points!

What role does demographic data play in the research?

- *How general are my knowledge claims? To establish boundaries of general vs specific.*
 - Another way to think about this might be to say, how bounded are my knowledge claims. Start with the assumption that your claims are bounded, and look very carefully for the bounds, rather than aspiring to generality.
- *To be intentional about inclusion:* Education cannot be done in a silo. We can shape our educational practises based on the demography we have. We will better able to represent, include everyone in the construction of knowledge.
 - As a corollary, you might want to “over sample” marginalised folks.
- *Sometimes the research design requires that we have knowledge of some specific aspects of participants social location*
 - Validation of the research, ownership of the participants, also for hypothesis testing a lot of times
 - To understand the link between how access affects representation, participation, achievement etc.
 - The research has an agenda and often to solve the inequalities generated from the education system.
- *This can help characterise the profile of the participants, which can help situate knowledge claims wrt the broader demography of the population. (or to help support/refute claims of “representative sample”)*

Keep these in mind when designing your own studies

Measurements Monday: 19/02/2024

Some of the questions that came up in Discussion Sessions

1. Demography info questions in Indian context
2. How to understand selection in research design

Demographic Questions in the Indian Context

What kinds of issues might arise?

Lack of shared language - Is there an easily recognizable term for non-binary in hindi/.../..., for example	Some demographics built into the sample itself. Sample might not be representative of all- Selection of site also constraints sample.
How to think about the complexities of bifurcating by caste, class. ... so many categories. Which categories to use?	Subjective vs. objective data. Framing the questions is important.

There aren't easy answers to all these challenges. Queer-Feminist understandings of gender deeply problematize ongoing research (both qual and quant). We need to engage deeply with different paradigms of thought and engage in reflective research and try new methods, esp ones that try to operationalise inclusion as defined by oppressed groups/communities.

Complicating the use of the terms transgender, non-binary

Drawing on: Dutta, A., & Roy, R. (2014). [Decolonizing transgender in India: Some reflections](#). *Transgender Studies Quarterly*, 1(3), 320-337.

- In South Asia, gender-nonconforming people (mostly folks Assigned Male At Birth (AMAB)) identify by a variety of indigenous terms - such as jogatas, thirunangai, dhurani, kothi, nupi manbi, hijra, kinnar, khwaja sira, ... the idea of “non-binary” is not, in that sense, *modern*, in the South Asian context.
- There is the harm of erasure if all these identities are subsumed as “Transgender” – something that is already happening via paperwork (ID cards, surveys, media discourse, etc.)
- These terms are also situated differently within class, caste, english-privilege, educational status, ...
- Working class hijra/kothi folks are gradually taking on the term, transgender, but “non-binary” def marks elite-ness

How do you describe your gender identity?

- | | |
|--------------------------------------|---|
| ☐ Hijra | ☐ Nupi Manbi |
| ☐ Transgender | ☐ Dhurani |
| ☐ Female | ☐ Jogata |
| ☐ Kinnar | ☐ Thirunangai |
| ☐ Kothi | ☐ Panthi |
| ☐ Male | ☐ Nupa Manba |
| ☐ Non-Binary | ☐ Other - Please Specify |
| ☐ Agender | |
| ☐ Queer | |

[POLL] Should we make the question optional?

- A. Yes
- B. No
- C. Other

[POLL] Asking the gender identity question this way makes sense to me:

- A. Agree
- B. Disagree
- C. Other

[POLL] Should there be “Prefer not to answer” option?

- A. Yes
- B. No
- C. Other

Should we ask about caste?

- A. How middle school students understand seasons? []
- B. How undergraduate engineering students solve open-ended design problems?
- C. How high school biology students reason about reproductive health?
- D. Does introduction of a teaching-software for inquiry-based science in 9-10 grade impact the retention of girl students in science?

[POLL] For which of the questions above should researchers in India record information on participants' caste?

None of them, A, B, C, D, Some combo of 2-3 Qs, All of the Qs, Other

Moved to Discussion Section Slides

Look through Shah et al. Chapter 2: Which categories did they include? (*Just the category names*)

[Poll] I understand why each of these categories is relevant to understanding gender experiences.

Yes No Unsure

Measurements Monday: 19/02/2024

Why did Shah et al. include “migration” in the participants’ profile? What’s that got to do with gender?

“Migration

Twenty-five of our respondents had migrated from their native places. Of the 11 who grew up in rural areas, only two had not migrated. Migration was largely propelled by tensions around gender and/or sexuality. All respondents who had moved had done so from smaller towns or villages to metros or large cities, drawn by the relative anonymity of the latter or by the existence of support groups. Some people had moved to bigger cities/towns to pursue their education. This latter category was made up of individuals who all identified as ‘woman’ or whose identities we have categorized as ‘others’, and came from middle-class backgrounds. All the migrants spoke of the greater freedom the new place enabled, giving them a chance to express their gender and/or sexuality.”

Excerpt From: Chayanika Shah. “No Outlaws in the Gender Galaxy”. Apple Books.

Moved to Discussion Section Slides

Should I record migration information for participants if I am trying to understand the experiences of women in say, a Chemistry [Undergrad] program?

[Poll] Should I record migration information for participants if I am trying to understand the experiences of women in say, a Chemistry [Undergrad] program?

- A. Yes
- B. No
- C. Unsure

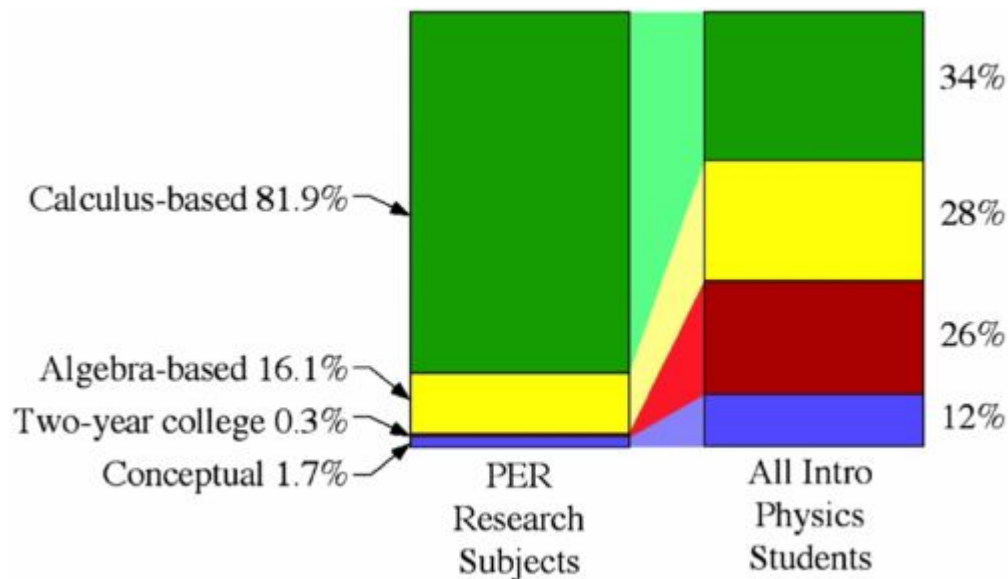
Moved to Discussion Section Slides

Which of the researcher decisions/choices bound the demography of participants?

Pick a box in the table and write in

Kanim & Cid (2020) - Result 3: In introductory physics, PER tends to focus on students in the calculus-based courses.

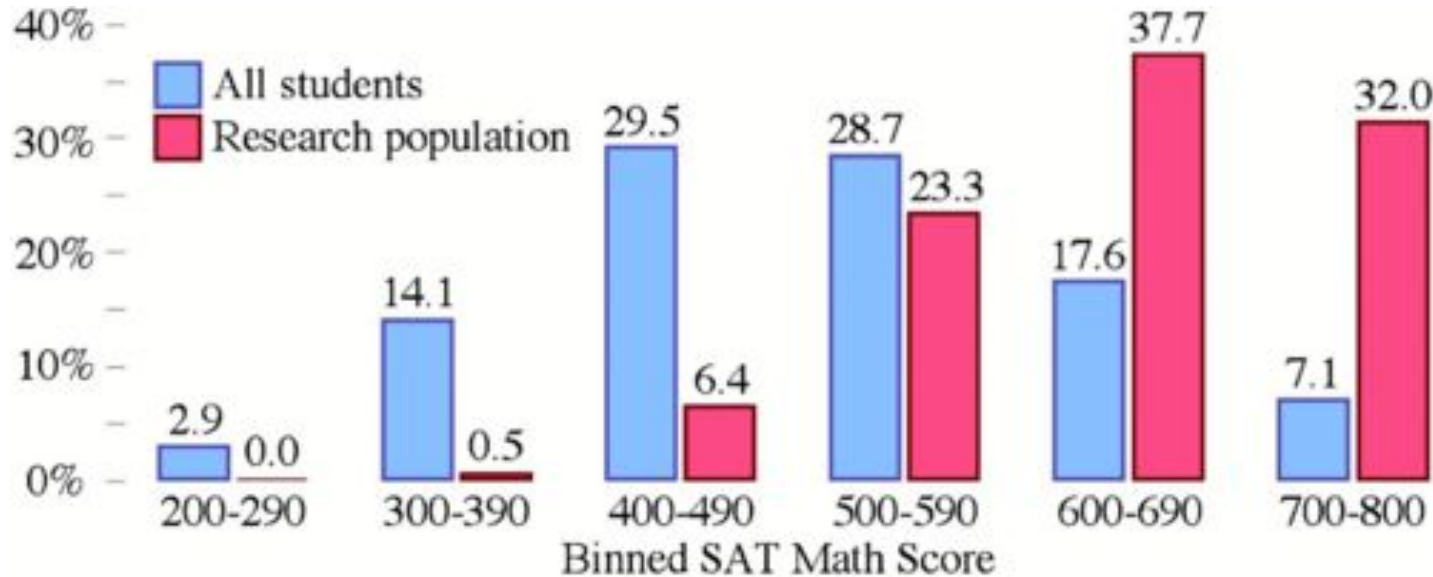
Kanim, S., & Cid, X. C. (2020). [Demographics of physics education research](#). *Physical Review Physics Education Research*, 16(2), 020106.



Calculus-based courses:

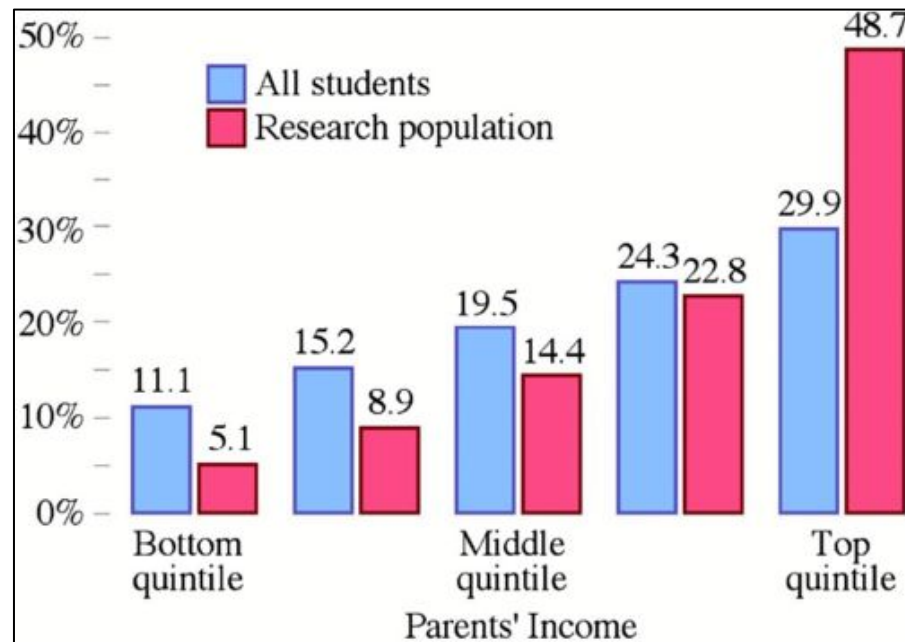
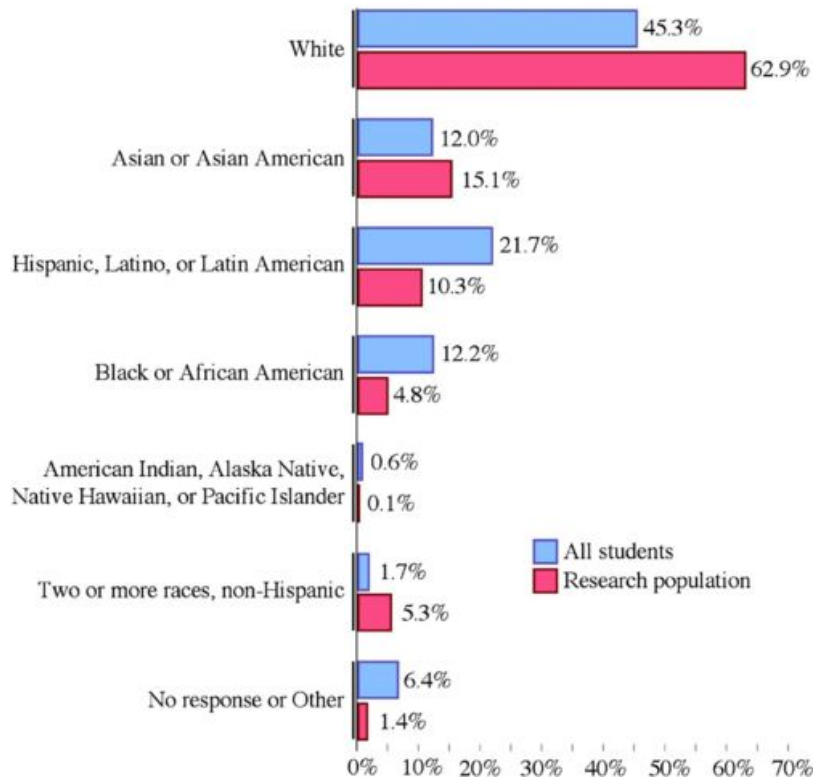
- More math prep
- Req. for Physics/Eng, not biology/medicine

Kanim & Cid (2020: Result 4: In introductory post-secondary courses, PER tends to focus on students with stronger mathematics preparation



SAT -
Scholastic
Assessment
Test - a
standardized
test used for
UG
admissions in
the USA

Kanim & Cid (2020) : Result 5: PER in the U.S. over-samples from White and wealthy populations



Why does the Kanim & Cid argument matter for research in physics education?

- Falsely amplifies claims as more general than they are
- Struggles of students in other courses are not attended to
 - Systematically marginalizes students from lower-income households, non-White students, students in non-elite institutions, students in community colleges, ...
 - Pedagogical models continue to bake in white cultural practices and norms, without being aware of it even

How did this happen?

In the USA, where a bulk of physics education research has been done, physicists started doing research on curriculum and pedagogy development in the USA. These folks tended to be tenured professors in the relatively elite institutions (public or private). They formed large research groups in PER with funding for large studies. They tended to rely on the courses that they or a colleague was teaching at their own institutions. Their colleagues were also at similar status institutions. So, these studies took place at the elite institutions, resulting in these patterns.

Things are changing though as the demography of physics education research itself is changing.

Moved to Discussion Section Slides

What might be implications of the Kanim & Cid study for Indian contexts?

When did Shah et al collect demographic data? Was that ok?

Moved to Discussion Section Slides

(for Survey) When should you collect demographic data?

- A. Always at the start of the survey
- B. Always at the end of the survey
- C. In the middle of the survey
- D. It depends
- E. Not sure

Understanding Stereotype Threat

Claude Steele: https://en.wikipedia.org/wiki/Claude_Steele

Psychologist - working on intellectual performance (gender, race), addiction ...

From an observer's standpoint, the situations of a boy and a girl in a math classroom or of a Black student and a White student in any classroom are essentially the same. The teacher is the same; the textbooks are the same; and in better classrooms, these students are treated the same. Is it possible, then, that they could still experience the classroom differently, so differently in fact as to significantly affect their performance and achievement there? This is the central question of this article, and in seeking an answer, it has both a practical and a theoretical focus. The practical focus is on the

Steele, C. M.
(1997). [A threat in the air: How stereotypes shape intellectual identity and performance.](#)
American
psychologist, 52(6),
613.

But this article focuses on a further barrier, one that has its effect on the already identified, those members of these groups who, having survived structural obstacles, have achieved identification with the domain (of the present groups, school-identified African Americans and math-identified women). It is the social-psychological threat that arises when one is in a situation or doing something for which a negative stereotype about one's group applies. This predicament threatens one with being negatively stereotyped, with being judged or treated stereotypically, or with the prospect of conforming to the stereotype. Called *stereotype threat*, it is a situational threat—a threat in the air—that, in general form, can affect the members of any group about whom a negative stereotype exists (e.g., skateboarders, older adults, White men, gang members). Where bad stereotypes about these groups apply, members of these groups can fear being reduced to that stereotype. And for those who identify with the domain to which the stereotype is relevant, this predicament can be self-threatening.

The Threat

Steele, C. M.
(1997). [A threat in the air: How stereotypes shape intellectual identity and performance.](#)
American
psychologist, 52(6),
613.

4. To experience stereotype threat, one need not believe the stereotype nor even be worried that it is true of oneself. The well-known African American social psychologist James M. Jones (1997) wrote,

When I go to the ATM machine and a woman is making a transaction, I think about whether she will fear I may rob her. Since I have no such intention, how do I put her at ease? Maybe I can't . . . and maybe she has no such expectation. But it goes through my mind. (p. 262)

Jones felt stereotype threat in this situation even though he did not believe that the stereotype characterized him. Of course, this made it no less a life-shaping force. One's daily life can be filled with recurrent situations in which this threat pressures adaptive responses.

The threat is “in the air”

Steele, C. M. (1997). [A threat in the air: How stereotypes shape intellectual identity and performance.](#) American psychologist, 52(6), 613.

Stereotypes around merit/intelligence/ability associated with marginalised groups

Negative stereotypes about women and African Americans bear on important academic abilities. Thus, for members of these groups who are identified with domains in which these stereotypes apply, the threat of these stereotypes can be sharply felt and, in several ways, hampers their achievement.

Steele, C. M. (1997). [A threat in the air: How stereotypes shape intellectual identity and performance.](#) American psychologist, 52(6), 613.

What can be examples of *stereotype threat* in Indian context? (*just examples of cultural-scripts, we will get into evidence later*)

Women are not good drivers	Women do not participate in sports enough. <i>You'd want to phrase this in a way that links to ability: such as men are better at sports → because we are trying to name scripts that pose a threat.</i>
Women are supposed to be multi taskers/good cook/homely	First generation learners' parents do not pay attention to HW/ class activities.
Girls are not good at maths	

We need to practice also thinking about other oppressive systems such as caste, ability, ...

Easy vs Difficult Math exam

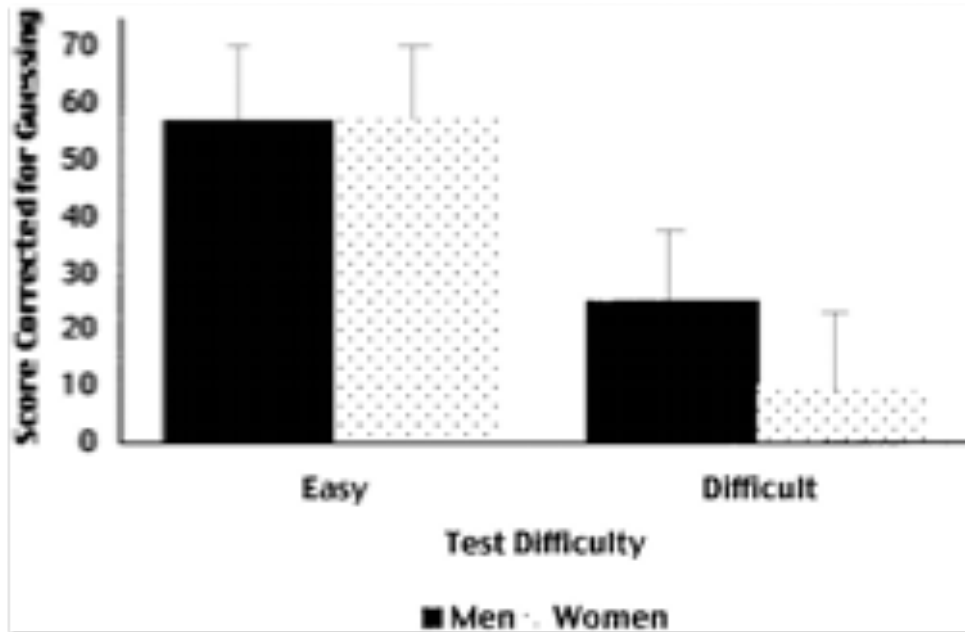


FIG. 1. Performance on a math test as a function of sex of subject and test difficulty

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). [Stereotype threat and women's math performance.](#) Journal of experimental social psychology, 35(1), 4-28.

Participants reported to the laboratory in mixed, male and female groups of three to six. They were told, “We are developing some new tests that we are evaluating across a large group of University of Michigan students. Today you will be taking a math test.” (M = 28; F = 28)

(PS: they also did a very hard history exam and did not find the difference. No stereotypes around men/women around performance in history exams)

but also think about how the machinery of testing, talent search, technocracy, job market, research, all work *together* to produce these stereotypes → the world needs to be arranged a particular way by hundreds of thousands of people for the stereotypes to originate and sustain over very very large periods of time → See for example the text excerpts from Gender (Geetha) on how the association of “men are better at science” is generated.

Alleviating the stereotype threat helps bridge the “gap” in this experiment

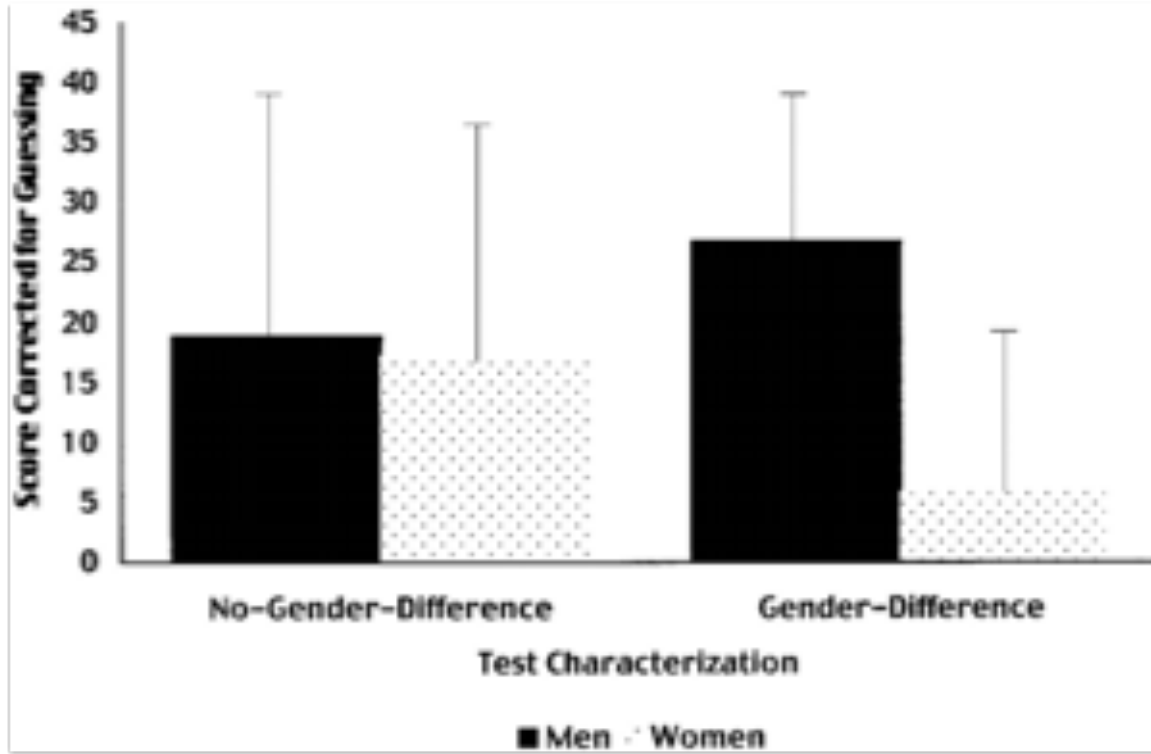


FIG. 2. Performance on a difficult math test as a function of sex of subject and test characterization

One group was told that test does not show gender differences.

The other, that it has been shown to.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). [Stereotype threat and women's math performance.](#) Journal of experimental social psychology, 35(1), 4-28.

Triggering the stereotype threat affected the performance of white male students who highly identified with math!

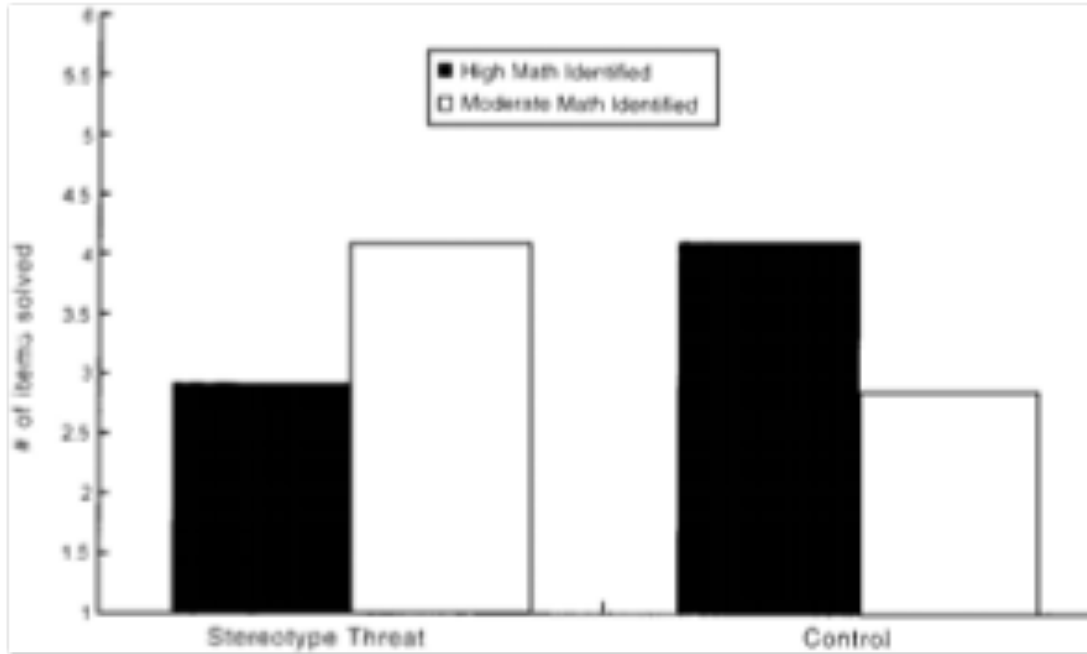


FIG. 1. Mean math test performance.

They went on to trigger the stereotype threat in white men! By alerting them of how Asian American students are outperforming white students in math.

Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). [When white men can't do math: Necessary and sufficient factors in stereotype threat.](#) *Journal of experimental social psychology*, 35(1), 29-46.

Moved to Discussion Section Slides

What does Stereotype Threat imply (esp for gender gaps work in STEM)?

Moved to Discussion Section Slides

How many women are there in your sample?

You did a survey with [Indian University] students on [Some Topic in STEM] and collected the following gender-data from 500 respondents to your survey (you gave the option of Male, Female, Transgender)

350 students reported Male; 100 reported Female; and 50 reported Other.

- A. There are 20% women in your sample
- B. There are less than 20% women in your sample
- C. More than 20% women in your sample
- D. Unsure

Moved to Monday, 26th Feb

Curious Outcomes

Haverkamp, Andrea, Johnson, Finn, Bothwell, Michelle K., Driskill, Qwo-Li, Montfort, Devlin. 2023. "Attack Helicopters and White Supremacy: Interpreting Malicious Responses to an Online Questionnaire about Transgender Undergraduate Engineering and Computer Science Student Experiences." Bulletin of Applied Transgender Studies 2 (1-2): 67-94. <https://doi.org/10.57814/qd1y-9b22>

What is power?

Moved to Monday, 26th Feb

Power

Given that others have written tomes about the construct of power, we cannot fathom providing a conclusive definition of the term in a few lines. The dictionary definition is a helpful starting point: “the capacity or ability to direct or influence the behavior of others or the course of events” (New Oxford American Dictionary, n.d.). We also interpret power as the ability to alter or maintain the physical, social, structural, cultural, and political conditions, resources, and/or opportunities of individuals and collectives (Baldwin, 2013; Collins & Bilge, 2016; Davis, 1983; hooks, 2014). From our perspective, power is co-constructed at multiple scales—historically and structurally at the macrolevel, at the organizational and institutional levels, at the interactional level, and in and through the bodies of individuals themselves. At each of these levels, power is simultaneously coercive with the threat of force and violence and also ideological in that it exists as assumptions of “commonsense” and practices taken to be “normal” (Foucault, 1979; Gramsci, 1971; Hall, 1996). The operation and outcomes of power are sometimes aligned across these levels and contradictory at other times.

Philip, T. M., & Gupta, A. (2020). [Emerging perspectives on the co-construction of power and learning in the learning sciences, mathematics education, and science education](#). *Review of research in education*, 44(1), 195-217.

Moved to Discussion Section Slides

Power & competition-experiences modulate testosterone levels (van Anders) → Implications for science education?

What's Next

Discussion Sessions (Wed & Sunday)

- Pls read Beddoes & Borega and the Brotman article (at least one)
- Bring demography data collection procedure for example research problem

For next week:

- Week 5: 26/02/24: Frameworks, Paradigms, Methodologies: Deeper into methodologies: Please read any two papers of your choice
 - Leyva, L. A. (2017). [Unpacking the male superiority myth and masculinization of mathematics at the intersections](#): A review of research on gender in mathematics education. Journal for Research in Mathematics Education, 48(4), 397-433.
 - Traxler, A. L., Cid, X. C., Blue, J., & Barthelemy, R. (2016). [Enriching gender in physics education research: A binary past and a complex future](#). Physical Review Physics Education Research, 12(2), 020114.
 - Slaton, A. E., & Pawley, A. L. (2018). [The power and politics of engineering education research design: Saving the 'Small N'](#). Engineering Studies, 10(2-3), 133-157.
 - McDermott, R., & Varenne, H. (2018). [Adam, Adam, Adam, and Adam: The cultural construction of a learning disability](#). In Successful Failure (pp. 25-44). Routledge.

Measurements

Monday: 26/02/2024

What are we doing today?
Some thoughts from the measurement module
((Then we move to Review of Research on Gender in STEM Education))

Course Early Feedback

I will prep a google doc with the summary of (6) responses. (by Wed, hopefully)

→ But get in your views and voices if you haven't had the chance.

Course feedback should be ongoing, and you should not hesitate to suggest ways in which your learning in the course can be enhanced. *Not taking the time you are spending here as granted. It should serve your growth & learning and your self-assessment matters.*

Measurements of Gender

- What is the nature of the construct you are trying to measure?
 - Gender norms and caste norms are associated. So, the psychological experience is shaped by both
 - Gender, Sex, and Sexuality are closely linked concepts
 - Gender, Sex, and Sexuality are dynamic constructs. They change for an individual over time, but also the cultural scripts associated with them change with time.
- What is the transformation-function (or relation) between the thing that you want to measure and the thing that the measurement instrument measures?
 - For e.g., are you measuring sex assigned at birth or how one feels inside at a given moment? → Which is relevant to your study and why? Etc.
 - Mismatch between instrument and construct: static/dynamic, independent construct vs entangled
- Thinking in terms of complex systems
 - Systems of oppression are linked. Frameworks for analysis of power are a guide.
 - Experiences, identities, cultural scripts, *and gender differences*... as emergent phenomena
 - Institutions-Structures-Policies, Cultural Scripts and Ideologies, Laws (social as well as judiciary/legislative), and interpersonal interactions are interlinked aspects
 - Work by van Anders and Claude Steele are examples

We all need to struggle with these, there are no easy packaged answers

What is power?

Moved to Monday, 26th Feb

Power

Given that others have written tomes about the construct of power, we cannot fathom providing a conclusive definition of the term in a few lines. The dictionary definition is a helpful starting point: “the capacity or ability to direct or influence the behavior of others or the course of events” (New Oxford American Dictionary, n.d.). We also interpret power as the ability to alter or maintain the physical, social, structural, cultural, and political conditions, resources, and/or opportunities of individuals and collectives (Baldwin, 2013; Collins & Bilge, 2016; Davis, 1983; hooks, 2014). From our perspective, power is co-constructed at multiple scales—historically and structurally at the macrolevel, at the organizational and institutional levels, at the interactional level, and in and through the bodies of individuals themselves. At each of these levels, power is simultaneously coercive with the threat of force and violence and also ideological in that it exists as assumptions of “commonsense” and practices taken to be “normal” (Foucault, 1979; Gramsci, 1971; Hall, 1996). The operation and outcomes of power are sometimes aligned across these levels and contradictory at other times.

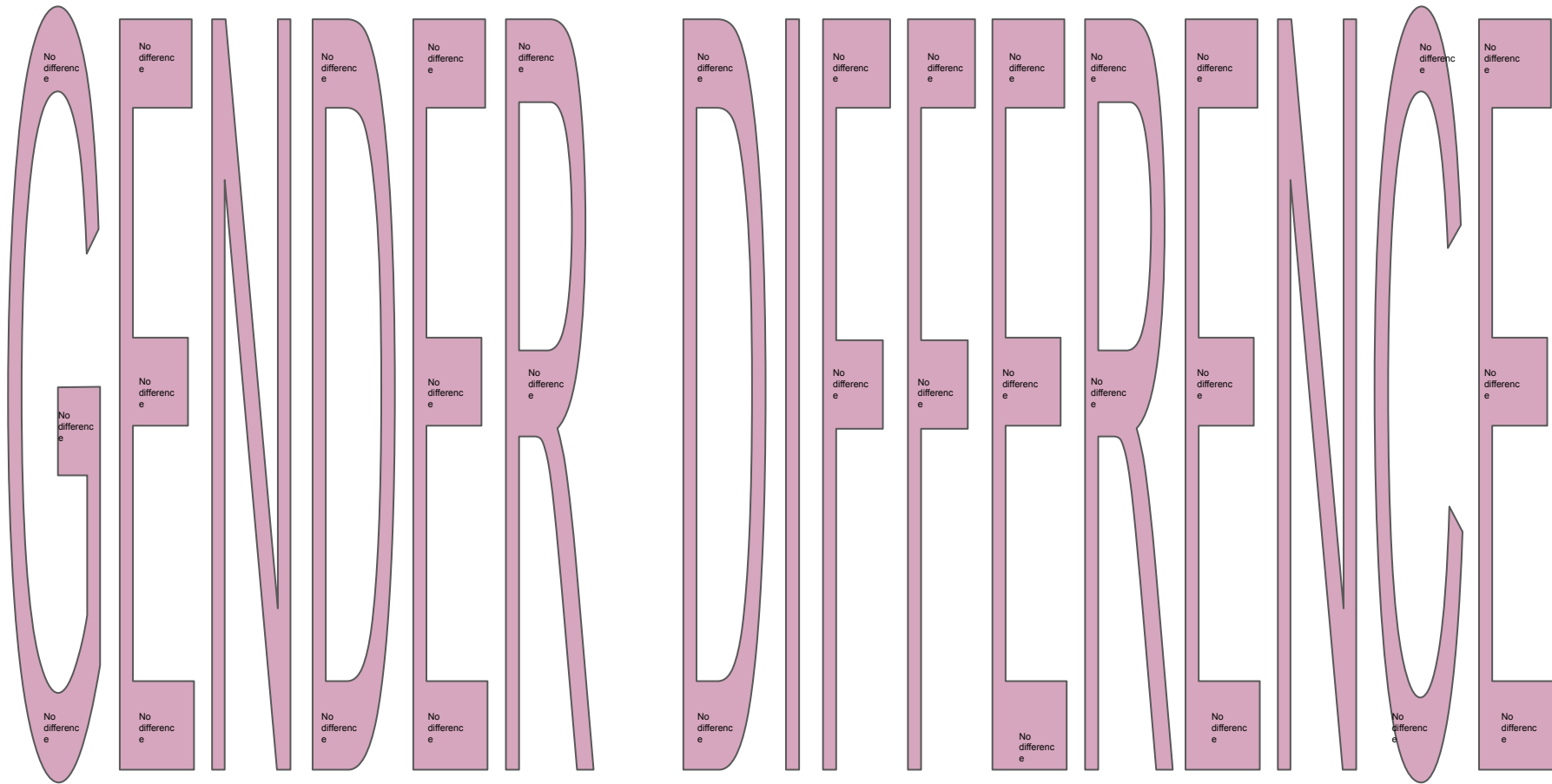
Philip, T. M., & Gupta, A. (2020). [Emerging perspectives on the co-construction of power and learning in the learning sciences, mathematics education, and science education](#). *Review of research in education*, 44(1), 195-217.

Gender Similarities Hypothesis

Hyde, J. S. (2005). [The gender similarities hypothesis](#). American psychologist, 60(6), 581.

“The differences model, which argues that males and females are vastly different psychologically, dominates the popular media. Here, the author advances a very different view, the gender similarities hypothesis, which holds that males and females are similar on most, but not all, psychological variables. Results from a review of 46 meta- analyses support the gender similarities hypothesis. Gender differences can vary substantially in magnitude at different ages and depend on the context in which measurement occurs. Overinflated claims of gender differences carry substantial costs in areas such as the workplace and relationships.”

You can also look up more technical work by Hyde, but I thought that this paper was quite readable, hence!



Moved to Monday, 26th Feb

Curious Outcomes

Haverkamp, Andrea, Johnson, Finn, Bothwell, Michelle K., Driskill, Qwo-Li, Montfort, Devlin. 2023. "[Attack Helicopters and White Supremacy: Interpreting Malicious Responses to an Online Questionnaire about Transgender Undergraduate Engineering and Computer Science Student Experiences.](https://doi.org/10.57814/qd1y-9b22)" Bulletin of Applied Transgender Studies 2 (1-2): 67-94. <https://doi.org/10.57814/qd1y-9b22>

Haverkamp et al., 2023, Abstract

Online research that solicits participation from marginalized communities or is conducted by scholars of marginalized identities may be targeted by individuals who intend to tamper with the study outcomes and/or harass the researchers. Our goal is to identify and interpret malicious responses recorded in a first-of-its-kind national questionnaire for transgender and gender nonconforming (TGNC) students in undergraduate engineering and computer science programs. **Data categorized as malicious (50 of the 349 total responses) contained slurs, hate speech, or direct targeting of the research team.** The data was coded inductively and discursively interpreted through social justice frameworks. The responses contained **homophobic, transphobic, ableist, anti-Black, antisemitic, and anti-Indigenous content.** Online memes associated with **white nationalist and fascist movements** were present throughout the data, alongside **memes and content referencing gaming and “nerd” culture.** Malicious responses can provide critical insight into the social conditions in STEM education. In application, we call for researchers to critically analyze, rather than discard, malicious data to shed light on these phenomena and generate empowering “counterspeech” to confront hate and reclaim agency. These findings show that **social justice STEM education must include perspectives on online hate radicalization and center anti-colonial, intersectional solidarity organizing as its opposition.**

This paper was challenged and rejected by Engineering Edu journals and almost did not make it through in a couple of journals, before being published here - a journal not widely read by engineering educators. But if you read the conclusions and discussion of this paper, you will get a sense for how different that is from the usual article in JEE, etc.

Open Questions on the Measurements Module?